

Aviation Week & Space Technology

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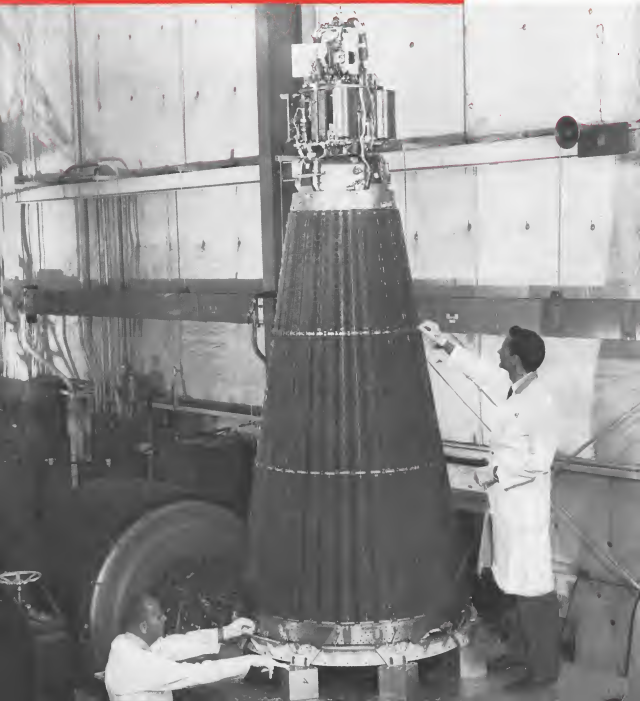
A McGraw-Hill Publication

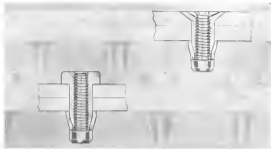
August 12, 1963

SPECIAL REPORT:

French Space Program Plans

Snap 10A Prototype





KAYLOCK® K-BOLTS

for blind and hard-to-get-to applications

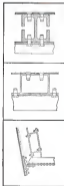
The K-Bolt measures up to and exceeds all the existing and proposed NAS specifications which set high standards of performance for single shear-double shear, tensile capabilities, sheet take-up, clamp-up, pre-load, tension-tension fatigue and sonic vibration.

Using existing crib lock tools, K-Bolts are easily installed from one side of the work surface in blind or limited access areas. They can also be applied in easily accessible areas where weight savings is an important consideration. It is possible to save up to 50% in weight over the conventional bolting methods. Also, assembly time and related costs are reduced.

The K-Bolt reflects many advances in manufacturing and metallurgical techniques. A truly reliable fastener from a manufacturer devoted to the design, production and marketing of aerospace quality products. Designed for structural applications, K-Bolt end assemblies are available with hex or flush heads, in nominal shock diameters. Write today for Bulletin 1622.

Kaylock 
just in all real life-looking pictures

KEYLOCK MFG CO., INC., KEYLOCK DIVISION • Box 3007, Fullerton, Cal 92631



Why is this the world's most reliable jet airline tire?

Airline records show the Red Steak by Goodyear is so ruggedly built it gives up to 15% more landings per tire. These are the reasons why:

REASON #1:

Shielded Wire Shield...

... located between the tread rubber and the tire carcass. Protects carcass from cuts, keeps small cuts from growing. The Payoff: Tires preserved for re-treading (often as much as 7 times) ... early tire failures virtually eliminated ... equipment efficiency increased.



REASON #2: Reinforcing Tread-Ply...

... buried deep in tread, permits use of extra rubber in tread. The Payoff: Tires protected from hazardous tread chalking and peeling under severe high-speed, heavy-load operating conditions of jet transports ... tread life increased.



REASON #3:

Automatic Wear Indicator...

... Unlike other wear indicators, red lined ply actually strengthens tire ... starts to show when

80% of the tread is gone ... tells when tire-change time is near. The Payoff: Safety factor increased ... tire inspection made faster, easier ... inspection costs cut.

REASON #4:

Low-Profile Rib Tread Design...

... puts more rubber where tire meets runway ... furnishes best balance for maximum tread wear and coefficient of friction under all runway conditions - snow/ice/wet/dry. The Payoff: Tread life increased ... braking better ... landings made safer, easier.



AND REMEMBER...

... the Red Steak Jet Tire by Goodyear is made with specially compounded tread rubber, composite-reinforced belted-rib ply construction, special super-strength beads, high-pressure curers and quality control that checks the tire at 140 points during production.

Why not get the world's most reliable ... and most economical ... tire as the wheels of your jets? Write Goodyear, Aviation Products Dept. H-1715, Akron 25, Ohio.

GOODYEAR
AVIATION PRODUCTS



For the most critical inspection use the finest-detailed American X-ray film—Ansco Superay H-D!

The most minute of all flaws register on Ansco Superay® H-D Film—highest-definition X-ray film ever made in America! This ultra-fine-grain Class 1 film is widely used in the missile industry as well as in the overhaul and inspection of commercial aircraft.

You would do well to ask your Ansco

Man for a demonstration of H-D. Or for details, write Ansco X-ray Sales, General Aniline & Film Corp., Binghamton, N. Y.



AEROSPACE CALENDAR

(Continued from page 5)

- Sept. 8-11—International Symposium on High Temperature Technology, Anaheim, Calif. Sponsors: Stanford Research Inst.
- Sept. 8-11—Ground Meeting, Air Industries Assoc. of Canada, Ottawa, Ontario, Ontario, Canada.
- Sept. 8-11—14th Annual Statistical Quality Control Institute, University of Connecticut, Storrs, Conn.
- Sept. 9-11—Scientific Meeting, Canadian Institute of Military Engineers, Institute of Electrical and Electronics Engineers, Sheraton Hotel, Washington, D. C.
- Sept. 9-12—15th Annual Instrumentation Conference, Instrumentation Society of America, McCormick Place, Chicago, Ill.
- Sept. 9-12—International Conference on Production Engineering Research, Carus Corporation, Technology and Machine Hall, Harrisburg, Pa.
- Sept. 10-12—National Symposium on Space Technology, Science and Recovery, Edwards AFB, Calif. Sponsors: American Astronautical Society, Air Force Flight Test Center.
- Sept. 10-12—New York University's Third Annual Air Transport Conference, Washington Square Center, New York, N. Y.
- Sept. 11-15—17th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—18th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—19th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—20th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—21st Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—22nd Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—23rd Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—24th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—25th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
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- Sept. 11-15—99th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.
- Sept. 11-15—100th Annual National Conference on Aerospace Electronics, Air Force Res. Dev. Center, Dayton, Ohio.

(Continued on page 9)

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PROBLEMATIC RECREATIONS 193



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When you, perhaps, at the recent Armed Forces Communications and Electronics Conference in Washington, D. C.? If so, you saw the new Lincrode system (from our RADCOM-Warner division). If not, here's the picture: a high-speed, multi-channelized system that sends a 300 line photo or other copy in 415 minutes. Weight of each unit (transmitter and receiver) is about 100 lbs; size is about 16x16x20. Further facts from: RADCOM-Warner, 540 W. 30th St., New York 19, N. Y.

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These are the new craftsmen—the men-on-the-line in a space-age world.

North American Aviation is at work in the fields of the future through these divisions: Science Center, Atomics International, Autosectics, Columbus, Los Angeles, Rocketdyne, Space & Information Systems.

AEROSPACE CALENDAR

(Continued from page 7)

- Sept. 26-Oct. 1-1961: Congress, International Association of Engineers, Paris.
- Sept. 27-28-8000th of Experimental Test Plan: Scripps, Annual Report to the Aerospace Performance and Analysis Research Society Hilton Hotel, Beverly Hills.
- Sept. 28-Oct. 1-Manned Interplanetary Expedition Meeting American Institute of Aeronautics and Astronautics, Columbia Hotel, Palo Alto, Calif.
- Sept. 28-Oct. 2-Canadian Electronics Conference: Test of Electronic and Electronic Equipment, Exhibition Park, Toronto.
- Oct. 1-14-Eighth National Symposium on Space Electronics, Institute of Electrical and Electronic Engineers, Fortescue Hotel, Miami Beach, Fla.
- Oct. 15-National Aerospace Nuclear Safety Technical Meeting, American Nuclear Society, Albuquerque, N. M. Co-sponsors: Los Alamos National Laboratory, AFSC Albuquerque Operations Office, AF Special Weapons Center, AF Directorate of Nuclear Safety, Sandia Corp., University of New Mexico.
- Oct. 2-4-National Assn. of Air Traffic Controllers, Sheraton-Edinboro Hotel, Ohio State Univ., Ohio.
- Oct. 2-6-North National Communications Symposium, Institute of Electrical and Electronic Engineers, Hotel Utah, Utah.
- Oct. 7-11-International Air Transport Assn. 1961 Annual General Meeting, Rome.
- Oct. 9-20-20th Annual Air Force Science and Engineering Symposium, Air Force Academy, Colo. Sponsors: Office of Aerospace Research, AFSC.
- Oct. 9-11-7th Annual Aerospace Electronics Conference, Aerospace Electronics Society, San Pacific Auditorium, Los Angeles, Calif.
- Oct. 12-23-1961 General Conference, Full Conference Aerospace International, Mexico City.
- Oct. 13-17-1961 Annual Meeting and Civil Service Airport Operation Council, Research Hotel, New Orleans, La.
- Oct. 14-18-1961 Annual Exposition and Symposium, Air Traffic Control Assn., Statler Hilton Hotel, Dallas, Tex.
- Oct. 17-18-Eighth Symposium on Radiative Transfer and Space Technology, Naval Training Center San Diego, Calif. Sponsors: AF Space Systems Div., AF Ballistic Systems Div., Aerospace Corp.
- Oct. 18-19-1961 National Vacuum Symposium, American Vacuum Society, Statler Hilton Hotel, Seattle, Wash.
- Oct. 27-31-4th, 31-25-North Atlantic America Conference, American Institute of Aeronautics and Astronautics-Canadian Association and Space, Statler Hotel, Amesbury, Mass. Sponsors: Boeing Manufacturing Institute of Technology, Cambridge, Mass. (Oct. 17-18). (Open: Statler Hotel, Montreal, Canada) (Oct. 19-22).
- Oct. 22-23-Tenth Annual Reg. Conf. Cos. Issues on Aerospace and Aerospace Electronics, Institute of Electrical and Electronic Engineers, Emerson Hotel, Belmont, Mass.
- Oct. 23-24-Conference on Spaceable Structures, National Civil Space Co.'s Super Camp, Dayton, Ohio. Sponsors: Astronautical Systems Division, Propulsion and Flight Systems Laboratories.

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TYPICAL OF THE BROAD LINE OF WESTON AIRCRAFT INSTRUMENTS

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ONLY INSTRUMENT OF ITS KIND - HAS INDEX FOR AUTOMATIC CONTROL

In outer space or at sea level, you can depend on Weston aerospace instruments for highest reliability and superior performance. This complex bearing structure holding instrument, for example, provides an accuracy of $\pm 0.05^\circ$ on the card and is equipped with an adjustable memory index for automatic flight control. Reliability is proved in rapid 1,000-hour MTBF tests—rather than by time tested under normal flight conditions.

Weston's high performance standards are achieved through a sealed air packaging technique and mechanical design, plus shock-tests, and rapid quality control. In addition, Weston offers unparalleled engineering expertise. We designed and built the original U.S. instrument and recently supplied nine of the 26 instrument assemblies aboard each Mercury capsule.

Take advantage of total Weston design and development capability. For more information, write Weston—producer of the best complete line of electrical aerospace instruments for manned flight. Dept. AV-46.

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WESTON INSTRUMENTS

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Raytheon electronics help guide Navy's new 2500-mile Polaris missile

The ability to strike anywhere on earth is defense of the free world. . . . this is the potential night of an improved Polaris, the submarine-launched ballistic missile. The new 2500-mile version—the A-3—gives the Navy a powerful countermeasure for an Polaris-armed undersea fleet, as potent as strategic space attack. And within the missile is a Raytheon-produced computer "brain" that directs the Polaris to its target with pinpoint accuracy.

The Raytheon digital computer is part of a redesigned, highly compact electrical guidance system, Mark II. Like the

Mark II size and weight of earlier versions, Mark II contributes importantly to the extended-range capability of the new Polaris. In design, development and production have been a joint effort of Raytheon and Massachusetts Institute of Technology.

Raytheon is proud to serve our fleet of nuclear submarines and the Polaris men who man them. . . . active, dedicated men who stand watch at the controls of freedom. Raytheon Company, Lexington, Massachusetts.

RAYTHEON



FROM CANNON TWO NEW DESIGNS TO INTERMATE WITH MIL-C-26500 and MIL-C-26482 CONNECTORS



KV

**MATES WITH
MIL-C-26500
CONNECTORS**

THREADED COUPLING



COMMON INSERTION/EXTRACTION TOOL—COMMON CONTACTS



PV

**MATES WITH
MIL-C-26482
CONNECTORS**

BAYONET COUPLING

- ASSURED INTERMATEABILITY—ELECTRICALLY AND MECHANICALLY
- PROVEN "LITTLE CAESAR" REAR RELEASE SYSTEM
- INTERCHANGEABLE CONTACTS FOR BOTH KV AND PV
- ONE INSERTION/EXTRACTION TOOL FOR BOTH CONNECTORS

Problems of increased pins, broken pins, reinserting, and connector failure are minimized by the hard-front, closed entry socket insulators and simplified contact design utilized in the KV and PV. Outstanding new design features: interperforate identical contacts and backshell for both connectors. . . . see common, plastic expendable tool provides safe insertion and extrac-

tion—no chance of damage to insulators, contacts, or sealing members. The KV and PV series substantially reduce assembly errors and provide greater standardization and reliability. . . . another reason why you should specify CANNON,® the world's largest and most experienced manufacturer of electrical connectors. Write us:

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SYSTEMS MANAGEMENT From high in the sky will come accurate plotting of the earth's surface. This will be made possible by Project "Sky Map"—the U.S. Air Force's new AN/USQ-28 geodetic survey and photo mapping system for which the Kollsman Instrument Corporation is systems manager. Designed for use in RC-135A jet aircraft, the system will consist of mapping cameras of advanced design, an extremely precise inertial navigation system, provisions for data recording and supporting electronics. The fastest means ever available for obtaining and computing geodetic information, "Sky Map" will also be the most accurate. The magnitude of the project is such that only a prime contractor with outstanding technical and systems management qualifications could have been considered. Kollsman has both.

Advanced Research
Aeronomy Instruments
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Circuit Systems
Circuit Electronics
Circuits
Systems Management



SYSTEMS MANAGEMENT DIVISION

Kollsman Instrument Corporation

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MATCHED TO THE JOB!



Long range Lockheed PV-2 Orion—designed for sub-surface patrol duties with U. S. Navy.

GM-Harrison forced circulation engine oil cooler—made to General Motors' traditional high standards of quality and reliability.



LONG-RANGING SUB-CHASER COOLED BY GM-HARRISON!

EXPERIENCE provides an invaluable source of knowledge for GM-HARRISON engineers. Aerospace, nuclear, marine, industrial, automotive. Every type of Harrison heat exchanger owes much to the flexibility of Harrison engineers with heat control problems in all these fields. This experience, and a complete line of basic designs to choose from, are the chief reasons why Harrison temperature control equipment is exactly **MATCHED TO THE JOB** . . . to provide an ideal combination of performance, reliability and economy.

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VIBRATION NEWS

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How do you measure reliability in vibration test equipment?

The basic function of vibration test equipment is to determine the reliability of the component, product or system being tested. It is therefore imperative that the test equipment itself be reliable.

How do you measure the reliability of test equipment?

The best criterion is the acceptance and record of performance of the equipment in the field. How many test systems have logged how many hours of efficient service? It is the wide acceptance of MEB test equipment among leading environmental test laboratories that is our most effective sales feature... and our best advertisement.

Today there are more than 6000 MEB vibrating test systems in use, some for as much as 18 years. This total includes 50 of our precision Automatic Equalization Systems which were introduced by MEB in 1968. Accuracy in equalization of the test specimen is accomplished with 50 channels



General Laboratory

fully automatic equalization systems. Complete equalization takes place in less than 5 seconds which means exceptional savings in test time, labor and money for routine

and aircraft manufacturers.

For information on the complete line of MEB test equipment write for Bulletin 120 to MEB Electronics, 3111 Whiskey Ave., New Haven 5, Conn.



Expanded Output Shaker



General Testing Laboratory



Precisely what time is it? No two clocks ever truly agree. When we want to talk really precise time, we must talk in fractions of a second. We must talk Sperry. Loran C. Loran C is the nation's most accurate long-range time distribution system. But it might not exist at all were it not for Sperry creativity. Since WW II, Sperry has explored uses for the great precision and range and the long-term economics of Loran. Many times working alone, Sperry pushed research and development of the system to extend its frontiers. Loran C today is aboard modern submarines; is vital to air, sea and space navigation; is an important link in our early warning system, and is itself a time standard at the Naval Observatory in Washington, D.C. If time is your problem, Sperry Loran may solve it. General Offices: Great Neck, New York.

SPERRY
DIVISION OF
SPERRY RAND
CORPORATION

STOKES NAMED PRIME CONTRACTOR FOR NEW DOUGLAS SPACE FACILITIES



Artist's concept of Douglas Aircraft Experimental Test Center. Stokes shows test model of vehicle attached to BT and being lowered into BT Stokes chamber. To the left are two Stokes "5 x 10" Gas in space with the other simulator now being obtained for it.

The Stokes Space Systems Department has been named prime contractor for the design and installation of three new space environment simulation chambers, key elements in Douglas Aircraft Corporation's primary financial Space Systems Center at Huntington Beach, California. The largest and most technically advanced space-test laboratory on the West Coast, the Center will be an integral part of Douglas Aircraft and Space Systems Division.

The largest chamber, 30 ft. in diameter, will be capable of testing fully assembled vehicles scheduled for manned flight. It will be used in the Saturn program, and in the development of lunar and planetary probe vehicles. The Stokes systems will represent the most advanced state-of-the-art on completion, and are designed for updating to even higher simulation parameters in the future. Stokes calls similar to those are now achieving simulation in the 10-15 ton range. High-speed engineering on all three chambers at 20% will assure the attainment

of true orbital vacuum, even under high gas loads. Stokes has assigned CryoVac, Inc. the design, fabrication and installation of cryogenic systems, and named Philadelphia-Daw Messer Steel Company to furnish and erect the large steel sphere.

A deciding factor in the selection of the prime contractor was Stokes' experience in designing and building large, first-of-a-kind space test facilities, such as those installed at Q-10 Space Technology Center. Another was Stokes' related background in space vacuum and cryogenics, as represented by General Electric's and Lockheed's SSS and DTC systems. To this experience, Stokes adds its long and successful history in the development of large-scale industrial equipment utilizing ultra-high vacuum, thorough engineering design and coordination, fabrication facilities, and field erection service . . . an integrated, start-to-finish capability unique in the entire area of space environment simulation. Space Systems Department, P.O. Stokes Corporation, 5380 Teller Road, Philadelphia 20, Pa.

F. J. STOKES CORPORATION: PHILADELPHIA / LONDON / TORONTO

STOKES

FLAME-PLATING: TOMORROW'S COATINGS...FOR TODAY'S WEAR PROBLEMS



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Aviation Week & Space Technology

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COVER: Technicians at Barnes International Div. of North American Aviation, Canoga Park, Calif., prepare a prototype of the Seta 10A System for Nuclear Auxiliary Power's 500-lb. light system for aircraft and aircraft tests. Other prototypes are being fabricated for flight test next year. Atomic International is developing Seta 10A for AEC.

REPRINTS

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EDITORIAL

Space Age Challenge to Physicists

On a recent spend at the College of William and Mary, Dr. Ralph A. Dreyfus, director, Administration of the National Aeronautics and Space Administration, pointed out the new opportunities provided by space flight for solving the most fundamental and intriguing questions concerning the universe. Because of the feasibility of Dr. Dreyfus' appointment, physicists to join in the space program, *Airline Week & Space Technology* is presenting excerpts from his speech—Ed.)

Man's newly won ability to leave the confines of earth and explore the frontiers of space offers a challenge and new opportunity for scientists of all disciplines.

With the invention of the telescope and . . . other scientific instruments . . . advances in the science of physics began to come more and more rapidly.

But impressive as the earth-bound data gathering has been, it is somewhat overshadowed by the events of only a few months last Dec. 18. On that day our *Messenger* 2 spacecraft flew past the planet Venus and resolved our most unscientific questions . . . which conventional astronomy had not been able to do in the 190 years since the invention of the telescope.

The data returned by *Messenger* 2 totaled about 65 million bits of information . . . (which) will eventually give us still more clues to the properties of our nearest planetary neighbor.

The study of physics in space is a new kind of operation. It is almost diametrically the opposite of nuclear physics, in which larger and larger machines are being developed to examine the interaction of smaller and smaller particles over smaller and smaller distances.

To the space science, on the other hand, we . . . employ extremely small devices to measure the physical phenomena . . . the entire scientific payload of the flight to Venus was less than 40 lb. and the payload to Mars will not be much, if any, larger.

The need . . . is for our creative physicists to think of simple devices, at least small ones, to make the critical physical measurements.

Let me sketch for you briefly a few of the areas in which I strongly believe it will be possible to open up completely new vistas of understanding.

First, I might mention cosmic inflation. Only recently have we even begun to comprehend what happens to the energetic particles . . . emitted from the surface of the sun or from other distant points in space and radiated through the universe.

The natural glow has long excited the interest of physicists. Only since the advent of rockets capable of penetrating the blanket of the atmosphere have we begun to understand the nature of the extremely energetic radiation called cosmic rays.

Of great interest to our national space program at the moment is the nature of the surface of the moon. As astronauts early noted that the moon's reflection of the visible light falling on it is remarkably uniform, approx. 10%. . . . Whereas the surface appears uniformly rough at optical wavelengths, it exhibits uniformly

smooth characteristics at radio and radar wavelengths, even down to frequencies of a few millimeters.

When we consider the theories propounded by some of our most knowledgeable and reputable scientists, we begin to realize how little we actually do know about the lunar surface. One group . . . believes the surface to be made up largely of dust particles, and that this surface layer may be inches or even several feet in thickness. Another (think the lunar surface is largely composed of porous rock).

Before we can undertake manned exploration of the moon, we need to know which, if either, of these theories is correct.

Let us consider some other problems . . . We now have two separate figures for the astronomical unit, that highly overcast measurement of the distance from the earth to the sun. This measurement is very important to us in the accurate computation of spacecraft over the vast reaches of the universe. . . . astronomers, employing optical methods, have obtained one figure, while radio experts have . . . shown a considerably different value. The difference is 60,000 kilometers. . . . Here is another challenge to physicists—the development of a new experimental technique that will resolve the discrepancy.

But these problems, important as they are, must take second place to some of the deeper ones that are closely intertwined with the very origin and nature of the universe. A cornerstone of Newtonian physics has always been that we consider gravity as a constant. Now, for the first time, we are beginning to have some reason to believe that the "gravitational constant," as called, is perhaps not really a constant at all, but that it decays with time.

There are yet other areas equally as challenging. In our radio astronomy studies of distant galaxies, sources of radio noise have been detected, so powerful that they could not have been achieved by any energy mechanisms we know of at present . . . (and) cannot be explained with present theories of the generation of energy in galactic events and our knowledge of gravitation.

From what we do know about the energy involved, with our present state of knowledge, it is probable that the entire mass of a galaxy might have to be destroyed in order to produce the effects we have detected.

Finally . . . we have never fully examined, in experimental fashion, one of the basic assumptions of Einstein's theory of relativity, namely, that the velocity of light is constant.

An experiment should be designed to determine whether the velocity of light is really constant or if it varies as a function of time. Certain phenomena, at present unexplained, such as the (incredibly rapid rate at which the universe appears to be expanding, might be explained far more cogently if . . . the velocity of light is not really constant after all.

Such questions as these, I submit, should challenge the best efforts of creative physicists for many years to come.



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WHO'S WHERE

In the Front Office

George L. Wilson and Ronald N. Campbell, executive vice presidents, Whiting-Dieter Electric Corp., Pittsburgh, Pa., and A. C. Mounts, senior vice president.

Ray W. Barlow, senior vice president-marketing, Univac Div. of Sperry Rand Corp., New York, N.Y.

Dr. Stanley P. Kozak, president of Micro-wave Electronics Corp., elected a director of Boston Electric Corp., Concord, Calif.; Eugene S. Cohen, president, Whiting-Dieter Technological Associates, Rockville, Md.; controlling Harold M. Rogers, resigned.

Alvin J. Key Thompson, secretary.

J. Elmer Morris, vice president, Missouri Manufacturing Co., Berkeley, Calif., and general manager of the California Div.

Dr. Carter H. Bradstreet, a vice president, IIT Research Institute, University of Illinois, Urbana, Ill.

Mervyn Levine, vice president-consultant, Electronics at Stanford, Palo Alto, Calif., a scholar of Radiation, Inc.

Donald H. Boyce, vice president and general counsel, Modcor Corp. of America, Princeton, N.J.

Dr. Eugene F. Carter has returned to the Development Corp., Santa Monica, Calif., as vice president and director of research following a one-year leave as U.S. Air Force Chief Scientist (MRS. Lillian H. Kennedy, Chief, Civilian Liaison, USAF Chief of Staff, permanent. Dr. Carter was the European Civilian Science Adviser.

Russell V. Paul, vice president-administration and finance, Mission Electronics Div., Mission Electronics Corp., Great Falls, N.Y.

John J. Douglas will become vice president of General Telephone & Electric Corp., New York, N.Y., succeeding Thomas A. Reed, retiring May 1. Robert J. Gosselin will succeed Mr. Douglas in position of Regional Electric Co., Inc., San Carlos, Calif., a subsidiary of GTE.

Frederick Seward, senior vice president-marketing and sales, Slick Airways Div. of the Slick Corp., will be superintendent at San Francisco International Airport.

John H. Thomas, vice president research and development, Duquesne-Corning Fiberglass Corp., Tarrytown, N.Y. William H. Castro, Jr., formerly vice president and general manager of the company's Pacific Coast Div., Santa Clara, Calif.

Trans Instruments, Inc., Dallas, Tex., has announced the following appointments: Vice President Fred Sney, in charge of the Aerospace Div., succeeding Vice President H. B. Whittemore, who will manage corporate research and engineering; Mr. Willis Morris succeeds Vice President R. W. Olson, now head of a newly created Special Projects Office.

May 4th Paul A. Garon (USA, Inc.), director of Research and Development, to the U.S. Naval Space Agency.

Col. Albert J. Wozniak, USAF, formerly assistant policy director of intelligence and logistics, now executive secretary for the Air Council.

(Continued on page 184)

INDUSTRY OBSERVER

Space Technology Laboratories is performing a detailed study of problems associated with a lunar exploration mission involving the launch of a pair of vehicles—one manned and the other containing cargo—directly to the moon. The mission under study calls for the men to return directly to the earth. The study—a four-month effort being conducted for Marshall Space Flight Center—contemplates an operational period of 1959-75 for stage designs adaptable for multiple use in direct-flight paths launched by Saturn V vehicles.

McDonnell Aircraft Corp. is preparing for a new round of major subcontract awards in its F-4 Phantom production program. The company has been asked by the government to seek subcontracting sources in Canada, in line with the Administration's desire to bolster U.S.-Canadian relations.

Data from Tera weather satellites, heretofore of little value in severe storm detection and forecast forecasting because of delay in relaying it to the Weather Bureau's severe storm forecast unit at Kansas City, will be available on direct relays through satellites of new equipment being completed this week. Height of the tornado season is in the spring, but some severe storm activity can still be expected this year.

USAF's Electronic Systems Div. has launched a program to develop requirements for a space command and control system. Initial work will be conducted by The Mitre Corp., Bedford, Mass.

NASA's Manned Spacecraft Center will sponsor a six-month study of the characteristics of an advanced high-gas, deep-space airplane to be used on manned space vehicles. Apollo would probably be the first application. Industry bidders will submit proposals by Aug. 23 for the study, which encompasses a desirable minimum to operate in the 2.1 to 2.5 km. range with at least 15 sh. per sec. flexible or inflexible types are being considered.

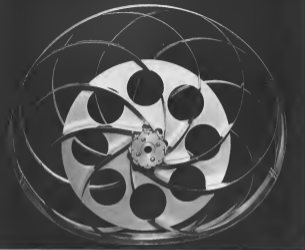
Naval Ordnance Test Station, China Lake, Calif., has discontinued the feasibility of a supersonic/hydrodynamic generator, using a liquid-fueled rocket engine exhaust exhausted at Mach 2.5 in the working fluid. Several successful test firings have indicated that the generator offers definite advantages over subsonic types. The small rocket burned gaseous oxygen and scrubbed exhaust. Certain catalytic seed material was dissolved in alcohol before firing.

USAF Space Systems Div. is expected within the next month to request proposals for a parallel competitive study of a structure system applicable to a wide range of possible future Air Force Space vehicles. The system—consistently an integral guidance system capable of accepting updating inputs from radar, star tracking, laser, and other center and planetary means—can first be applied in some of the more complex missions planned for the Tera 1 (NAV-June 17), a reconnaissance satellite which will carry gear for the studies include AC Spark Plug, IBM, Honeywell and Space Technology Laboratories.

Rockwell Air Development Center is seeking qualified sources to design and build a scaled array of modularized-type lasers. This is part of several programs which are attempting to overcome the limited output power levels of present lasers by combining the outputs of many devices.

Industry will submit bids to Jet Propulsion Laboratory by Aug. 23 for a study of the effects of payload distribution and long-term exposure to hard vacuum on parabolic systems to be used in deceleration of soft landing payloads at the end of a piloted flight lasting up to 160 days.

Manned Spacecraft Center is expected shortly to request proposals for the personal life support systems to be worn by Gemini astronauts during extravehicular activities. The portable systems—developed by the NASA center—would be strapped on the back in lieu of the crew suitcases just prior to leaving the spacecraft. The system would include its own backup provisions. The only connection between the astronaut and the capsule would be a tether line and possibly a communications line.



WE JUST INVENTED THE WHEEL, AGAIN . . . Wheels are the most popular locomotion mechanism on earth today. How about on the moon? Considering the harsh lunar environment, the unknown characteristics of its terrain and the questionable soil strength, are wheels also suitable for locomotion on its surface? Bendix engineers are seeking the answer. As part of the company sponsored Lunar Roving Vehicle Program, Bendix has developed several lunar wheel configurations with such desired characteristics as reliability, efficient traction on a wide range of soil conditions, quick damping reaction and negotiability over and around obstacles—all at minimum weight. If you are an engineer or scientist in the space technologies, and would like to join this team for greater personal recognition and opportunity, please contact our Personnel Director, Bendix Systems Division, Ann Arbor, Michigan. An equal opportunity employer.

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Washington Roundup

Test Ban Tremors

Nuclear treaty tremors will be set off as the Senate this week when Dr. Edward Teller tells the Senate Foreign Relations Subcommittee in closed session his own fears about burning fuels in the atmosphere, outer space and under water. Dr. Teller long has feared continued development of nuclear weapons and was the leading backer of the hydrogen bomb.

But Dr. Teller's reservations and Senator fears about Russia cheating under the ban are not considered enough to prevent approval of the treaty. Senate Democrats and Republican leaders have decided to press for a favorable vote after an intense examination of the document.

Key witnesses in the view of such apprehensive Senators as Henry M. Jackson and Jacob K. Javits are members of the Joint Chiefs of Staff. If they endorse the treaty, the treaty needs no real military aid, then the Senators feel they can go along with it in good conscience.

Official focus for the treaty is the Senate Foreign Relations Committee. Chairman J. W. Fulbright has invited Senators on the armed services and the joint atomic energy commission to participate in the hearings. Propensity subcommittee conducts its examination of the treaty as part of continuing hearings on national security.

Lead-off witness before the Senate Foreign Relations Committee will be Secretary of State Henry Kissinger. He will be followed by Defense Secretary Robert S. McNamara and the joint chiefs. Senators will question them and other witnesses closely on U. S. capability for detecting nuclear explosions (AW Aug. 5, p. 17).

Comsat Corp. vs. FCC

Communication Satellite Corp. exploded the usual bureaucratic inertia and boldly told the Federal Communications Commission to send its own business out of its way to turn the corporation into offering stock to the public. It was the first public clash between the two groups.

Law D. Wilch, corporate chairman, wrote the FCC last week that the stock would not be issued until the corporation was good and ready—"not later than the early part of 1964." He argued that the corporation should not offer stock until after enough information was developed to inform the investing public about the risks involved.

"Studies relevant to such factors as liquidity, stability, market history, multiple basis, equality, control power, satellite distribution and ground station configuration are all under preparation, as guaranteeing the competence of my stock system, and we are engaging in such studies," Wilch wrote the FCC. Results of these studies will be given to potential investors.

FCC fears that delaying the public stock sale will result in the temporary board of directors making fundamental decisions without approval of future shareholders. FCC Chairman L. William Hunt expressed these fears in a letter to Wilch July 23, and also directed how a \$600,000 loan to the corporation should be spent. Wilch replied that such restrictions were "an invasion of the managerial functions of the corporation," adding that additional studies might be needed through discussion.

DDOE Shifts Continue

Big changes of key personnel in the office of defense research and engineering is continuing. These are the latest changes. Lt. Gen. William J. Ely, formerly of Army Materiel Command, has replaced Rear Adm. Charles E. Merrill as deputy director for administration and administration. John Merrill now commands the Second Fleet at Norfolk. Ronald M. Murray, formerly manager of extraterrestrial programs for Hughes Aircraft Systems Div., has replaced Arthur Robinson as assistant director for DDOE's extraterrestrial programs. Robinson has returned to General Electric's Missile and Space Div. James W. Russell, former marketing manager for Ford's Lincoln Aircraft Division, has replaced Robert Tucker as assistant director for engineering management. Tucker has joined the Northern Corp. David J. Peck, former vice president of Allied Research Associates, has replaced B. F. Holmes as assistant director for defense systems.

An Force is asking Congress for \$2.5 million in construction funds for Fiscal 1964 to improve its facilities at Cape Canaveral. One of the new facilities sought is a 15,000-sq-ft biostationary operational support unit to replace five technicians at the Cape which must be visited twice because of their necessity to use launch sites.

TFX-VAX

Boeing has submitted a design for the VAX attack aircraft which Postage was just declined the F-111 because it is a half-size version of the company's being proposed for the F-111 (TFX) tactical fighter.

—Washington Staff

Status of Fiscal 1964 NASA Authorization

(In thousands of dollars)

	NASA Request	House Approved	Senate Counter-Proposed
Research and Development:			
Maneuver spacecraft system	1,536,400	1,436,600	1,536,400
Launch vehicle and propulsion system	1,168,500	1,168,500	1,168,500
Aerospaces medicine	16,700	11,000	11,000
Intelligence and checkout	103,000	125,000	140,000
Systems engineering	37,000	37,000	37,000
Meteorological satellites	63,700	63,700	63,700
Communications satellites	21,100	42,175	44,175
Advanced applications satellites	1,900	0	0
Industrial applications	3,500	3,500	3,500
Geophysics and oceanography	194,400	190,400	194,400
Lunar and planetary exploration	372,400	354,400	362,400
Robotics	35,200	31,200	31,200
Launch vehicle development	120,700	127,700	127,700
Facility, building and research grants	35,800	38,400	36,800
Space vehicle systems	41,862	53,462	53,462
Electronic systems	30,362	30,362	30,362
Human factor systems	18,200	13,200	13,200
Nuclear-electric systems	68,748	68,748	68,748
Nuclear reactors	96,487	96,487	96,487
Orbital propulsion	22,407	24,407	24,407
Space power	16,424	16,424	16,424
Aeronautics	16,200	16,200	16,200
Training and data acquisition	231,500	214,700	229,200
TOTAL	4,351,700	4,013,175	4,229,275
Administrative operations	840,300	598,185	529,185
Construction of facilities:			
Aeronautics Center	13,076	11,944	11,944
Flight Research Center	4,081	0	1,157
Goddard Space Flight Center	36,122	17,032	30,332
Jet Propulsion Laboratory	7,900	2,998	2,998
Langley Research Center	8,768	8,260	8,260
Launch Operations Center	312,838	279,407	269,136
Lewis Research Center	35,835	16,434	16,434
Marshall Spaceflight Center	37,736	35,192	35,192
Merrill Space Flight Center	28,476	26,980	26,980
Michoud Field	30,802	8,488	8,488
Mississippi Test Facility	111,490	92,496	102,796
Naval Research Development Station	30,490	18,490	18,490
Various locations	176,838	148,653	148,363
Wallops Station	2,900	0	0
Facility planning and design	30,800	18,000	25,000
TOTAL, construction of facilities	880,800	682,329	747,000
GRAND TOTAL	\$,732,900	\$,503,779	\$,511,829

program area. Some important projects within the program, for which funds were not authorized include:

- Apollo spacecraft development—See the Space Commission report of all the \$170 million (not by the House from NASA's \$1.2 billion report)
- M-4 engine—\$15 million of the \$30 million can be the House was omitted.
- Saveroy Okkley—Somehow cannot restore the \$20 million Service Orbiter program which had been eliminated entirely by the House.
- Mississippi Test Facility—Somehow

cannot restore all of the \$13.5 million from funds requested for construction of an S-1C test stand, all of the \$1.5 million for team funding, for an S-2 stage drive test facility, and all of the \$4.5 million House reductions in funding for work on an S-1 test stand.

- Launch extension module test facilities—\$1 million was restored to the Senate committee to funds requested for a test facility at White Sands Missile Range.
- Launch Complex 9—\$15 million of the \$25 million requested for work on Station 3 launch facilities was omitted.

along with \$2.1 million for a control or instrumentation facility and \$105,000 for an optical and electronic component servicing facility at Canaveral.

- Apollo tracking ships—Senate, counter-offer recommended \$40 million of the \$10 million NASA asked for three tracking ships, as opposed to \$10 million voted for the House.
- Meteorological System Laboratory—Restored the \$2.5 million (the Gulf of Mexico Flight Center facilities, which had been eliminated entirely by the House.

Zuckert TFX 'Rough Judgment' Charged

By Donald E. Pisk

Washington—Sen. John L. McClellan (D-Ark.) last week accused Air Force Secretary Eugene M. Zuckert of using the word "shockingly rough judgment" the Defense Secretary Robert S. McNamara used in selecting General Dynamics over the Boeing Co. for the F-111 TFX tactical fighter contract award (AW May 8, p. 24).

Sen. McClellan made the charge during the continuing probe of the F-111 bid by the Senate Permanent Investigations Subcommittee. Continuing the Zuckert should have further investigated the difference in the two companies' cost proposals (AW Aug. 5, p. 38), McClellan said the only reason Zuckert had to show was a cost comparison memorandum prepared Nov. 17, 1962, by James E. Williams, Jr., assistant to Deputy Assistant Secretary of the Air Force.

McClellan asked Zuckert if he had any other documents or calculations that would justify that data, as the cost differential between the two proposals.

Zuckert said he had no other calculations. "But on the other hand, I did analyze the evidence with such people as Dr. Clark" and the Secretary of Defense.

"That is a rough judgment I am making, about," McClellan said. He then asked Zuckert if he prepared any document analyzing the effect the war was on the Boeing's Wichita, Kan., as would have on lowering their cost estimates.

"Have you any charts or anything where you made the calculations along these lines to satisfy yourself?" McClellan asked.

Zuckert replied that he "didn't have to have calculations to weigh it."

He added that he "had what in my opinion was adequate discussion with Secretary McNamara, Williams (and others) to confirm my own impression of the cost proposals."

Zuckert said it "was quite true that Boeing had used bomber experience. B-70 and B-57, as this was for its cost estimates."

In his report, Williams and Boeing cut their initial-bid estimates by 30% for the manufacturing effort, because their own non-people-to-people contracts showed on the B-57 cost \$2.5 million as opposed to an industry average for \$9.5 million.

"In their opinion, since they had the bomber experience (by about 30%), they can best the industry average of 26.5 million by about 30%," he then charged a factor of 35 (for the F-111), Williams said. He added in the report that

he "cannot agree with this rationale, (because) the Boeing experience on bombers is not directly transferable to production of fighters."

Zuckert said Boeing's manufacturing losses were less per pound than for any modern fighter, "and even the B-58 and the F-4 of World War 2 type."

Zuckert added that the fourth evaluation hearing and the briefing session also gave indications of the cost differential and concluded "I don't want to leave the slightest impression that the matter did not get my own serious attention and consideration."

Earlier, Zuckert had challenged information provided by Thomas A. New, wily, a General Accounting Office accountant on loan to the subcommittee, which prepared to view that Boeing's pre-proposal costs—based at \$415,615 below General Dynamics—were due primarily to the lower wage rate at the Wichita, Kan., site.

McNamara said a 72-cent difference between rates at Boeing's Wichita, Kan., and General Dynamics' Ft. Worth, Tex., was presented Boeing to quote labor costs \$361,922,000 lower than General Dynamics.

Zuckert then pointed out that Boeing had estimated it would take 45,000,000 fewer man-hours in its proposal and that this would account for \$161,679,000 of the labor difference. A low cost made of the labor required to produce

the F-111 throughout its full production run was one of the elements Zuckert considered significant in Boeing's proposal.

Zuckert further stated that about \$219 million of a \$311,999,800 advantage credited to Boeing for lower overhead costs also was due to the lower number of man-hours in each proposal. He also charged the \$74,040,000 figure which the subcommittee had approved Boeing's higher material and other costs. Zuckert said the material cost "was a very small percentage of the material and other costs."

Zuckert said that "I don't put" of Boeing's \$30.6 million labor profit was "attributable to the difference in the rates of the difficulty of doing the job."

Zuckert said that most of the \$485 million difference could be attributed to the different number of hours, "without taking into account the labor rate. It is, in effect, a credit of 12 cents added to what the Boeing Co. and 94 million man-hours, or whatever the General Dynamics figure is, the price for the job would be about the same as General Dynamics proposed."

Normally, said it was possible to "in target it that way" ... But I prefer not to do it that way."

The Williams memorandum, which Chairman McClellan said was Zuckert's sole document comparing the difference

TFX Prototype Contest Idea Revived

Washington—Questions of conducting an F-111 (TFX) prototype competition between Boeing and General Dynamics was raised again last week during Senate hearings on renewal of the contract to General Dynamics.

Sen. John L. McClellan (D-Ark.) asked Air Force Secretary Eugene M. Zuckert if he had any current commitment to having "the two companies build prototypes and have them tested and then let the plane that is best."

Zuckert replied taking a few steps on the same, saying that he had only tentative views on the value of such a competition. He said he was not "opposed to the idea itself," but cautioned that it could cost more delay, since in the F-111 program, preparations for production are scheduled to begin while the research and development program is still under way.

Boeing earlier had said they could build two prototypes for \$105 million (AW May 8, p. 24), but Defense Dept. officials asserted the idea, as did General Dynamics (AW May 13, p. 27). Sen. Karl E. Mundt (R-S.D.) said last week, however, that some thought is being given to Congress in approving up to \$400 million to permit the two companies to build two prototypes each by a contract.

McClellan asked an Air Force-sponsored Rand Corp. study, which concluded that "the expanded prototype approach should be most widely applied to aircraft development program" (AW June 10, p. 119), and asked Zuckert if he spent work at.

Zuckert said there are advantages to the prototype approach, but added that it could not be done quickly which is the better approach. "You don't have about a weapon system until you have said it," he said.

He added that there was not time for a prototype competition, because General Dynamics was seven months into the research and development program and would have to "lose going for production with Fiscal 1965 funds" to meet the tight delivery date.

between the two companies' cost proposals in the period shortly before the contract award, was mentioned in the contractor hearing record.

In the report, Williams said "negotiations with both contractors would result in a lower contract price. However," but he recommended against conducting such negotiations, because he couldn't agree with some of the reasoning used in the Boeing proposal. He listed three reasons for Boeing's lower cost proposal:

- Negotiations would start at a lower level.
- Boeing can spread their overhead on a larger base.
- The Boeing rates at Wichita are significantly lower.
- Proposed Boeing tooling, even in the EDT&E (research, development, test and evaluation) phase is simply tooling designed for large quantity production.

Boeing's poor performance, even though it is not for lighter needs, shows they are best the industry now have averages. But that plus the company's desire to support this reputation will contribute to a lower price.

Williams added that "because the contract price with Boeing would be lower, it would not be sufficiently low enough to warrant using price as the sole determinant in awarding the contract. The only way to prove that one contractor price would be lower than the other would be to negotiate with both companies, and that is not recommended."

Zachert pointed out that Williams said the "price proposed by the contractor are just that—proposals as a starting point for negotiating a contract price." He said Williams cited "in feeling that the Air Force's attitude represents a much greater realistic estimate of what the proposed program will cost."

The reference to Air Force cost estimates prompted Jerome S. Adkinson, general counsel for the subcommittee, to ask Zachert if "you and your office have read the Air Force estimates on which to base a judgment as to the validity of the cost estimates in both Boeing and General Dynamics?"

Zachert replied that in earlier testimony he had spelled out "the purposes for which I used the Air Force cost standards, and I did rely on them as a step in the judgment-making process about the wisdom of the cost proposals made by the contractors."

Zachert had been asked at that time if he agreed with McNamara's statement that the Air Force figures were "unreliable" but he could not use them in making a final decision on award of the contract, and therefore had to make a "rough judgment."

Zachert replied that he said the fig-

ures for "two of the three" major steps involved in the final decision, and those that the figures were of some use to him.

Adkinson said that appeared contrary to him "to the position that Secretary McNamara took," when he stated those could not be used at the overall level, because they were considered too unreliable.

Zachert said that during the earlier exchange he had attempted to interpret what the secretary meant—that the figures perhaps were unreliable for the final decision process, but nevertheless of some value in decisions leading up to that—but "I don't disagree with Secretary McNamara."

Zachert also was asked about the past performance records of the two contractors and whether General Dy-

son's history of 4.8% overruns, according to subcontractor figures, and Boeing's 2.6% under runs on contract costs were considered significant.

The secretary replied that "the problem of overruns/under runs is one of the standards in this business" and that "if you accept Mr. McNamara's figures... I still say that subcontract you don't know anything" because they are not significant.

The chair had no intent in showing which contractor did the better job, because General Dynamics' work on the B-58 was "many times more difficult" than Boeing's work on the B-52, Zachert said. The B-53 was the first supersonic bomber and made tremendous advances in the state-of-the-art, he said.

Merritt Island Telephone Award To Be Reserved for Southern Bell

Cape Canaveral-Norfolk Aeronautics and Space Administration last week refused the unopened bids of 10 firms vying for the communications contract on the newly Merritt Island Launch Area (MILLA) and announced that the awardee bid request would award the launch telephone portion of the contract for Southern Bell Telephone Co. Southern Bell and its parent corporation, American Telephone and Telegraph Co., objected to NASA's launch operations center here and NASA headquarters, Washington, D. C., respectively, that the local contractor was prohibited to handle the commercial telephone part of the contract under established rules. Through the successful awardee contractor, NASA had planned to purchase, install, operate and maintain its own phone system and to contract with the carrier's trunk lines as the Florida mainland. The arrangement is common to all Defense Dept. bases and military centers and has been agreed to by carriers in the interest of national defense.

Telephone companies agreed that NASA, as a civilian agency, could not permit this defense-type of installation. At stake, in the opinion of some observers, was not so much an interference as a reliability as it was a fear as the part of the carrier that NASA's MILLA facility might lift a precedent for other nondefense government agencies and, eventually, private concerns to develop their own systems. Installation designs and equipment have been a significant part of carrier's mission would be devoted to the telephone companies if users began buying phones from sources other than the monolithic trunk lines of the carriers, such as Western Electric, and installing the equipment themselves.

AT&T also was not to have made the point, in pleading Southern Bell's case, that chiefly of long-distance calls occurred irrefragable equipment at each end of the line, as well as in the circuits in between. One NASA official said that neither he nor other NASA personnel who participated in the two-week long discussions with the carrier contracted in an advance notice that the space agency could expect little assistance from the Bell System if it went ahead with its original plan, installed its own equipment, and difficulties later developed. But another NASA official said the warning was explicit in the carrier's own actions at the point.

NASA agreed to let Southern Bell handle all communications administrative functions on MILLA, including their installation, operation and maintenance. The agency did, however, insist on retaining the right to install and control all telephones in noncommercial or critical areas, such as the launch control center for Saturn 3-Apollo. The station yielded to NASA on this issue and so the successful communications contractor will be responsible for approximately 980 of the 5,000 telephones to be installed entirely next year on the Merritt Island area.

Bewritten bid requests are expected to be issued again this week. Plans covering the new requests will have 21 days in which to resubmit their bids. Contract will cover all cable plant and radio-frequency transmissions in the Merritt Island Launch Area. This will include all data, signaling, microwave, voice, telex, intercom and sounddown distribution systems. New request also includes a provision on earlier planning support for future expansion of the MILLA communications system.

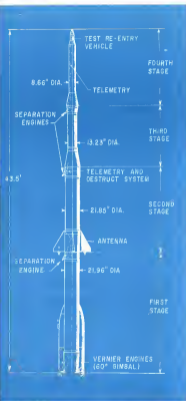
Title 3 Transtage Firing Shown

First long-duration firing of an integrated USAF Titan 3 transtage propulsion system involving multiple transtage thrust occurred in Sacramento, Calif. (AAS July 29, p. 27). The engine was started three times and sustained twice during the 204 sec. run. Similar test firing is shown below with stress coming from the test stand at right. Inset photo shows model of one of the two engines that will power the transtage of the Titan 3, Hughes, which develops 8,000 lb. thrust each, are built by Aerojet-General. Transtage is manufactured by Martin Marietta Corp. Transtage is the third stage of the Titan 3A and the fourth stage of the Titan 3C. Long-duration test was held at start of the planned 6-month duration when a hot spot developed at the junction of the injector and thrust chamber.



French Use Berenice In Nose Cone Tests

French Berenice, low-stage solid propellant rocket designed to evaluate proposed nose cone configurations both ablative and heat sink, was launched on May 15, p. 14, in a series of dynamic flights of its overall configuration. Nine separation boost regions to aid stage separation following firing of explosive bolts, as for first-stage separation, and four such fast fluid and thrust stages. Ground-controlled descent system is tested in second stage. Two telemetry systems are tested. First two stages are ejected at about 14 ms altitude during descent to propel the next cone to a Mach 12 re-entry test speed. Maximum altitude of trajectory is about 170 mi. Nose cone designed by Sud Aviation is shown on 7,400-lb. Berenice vehicle (below, left) about to launch on the Dec de Lorient coastal ocean test facility. With first stage ignited (below, right), Berenice begins 5.5 min. flight lasting about 70 mi. above the Mediterranean coast. Berenice was designed by Office National d'Etudes et de Recherches Aérospatiales in collaboration with the Institut d'Etudes de la Propulsion des Rockets.



Cape Contracts Total More Than \$60 Million

Cape Canaveral-More than \$60 million in construction contracts for the Navy's 5-Apollo and Titan 3 facilities have been awarded here by the Army Corps of Engineers for the National Aeronautics and Space Administration and USAF.

The post firm of Paul Henderson Inc., and Morrison-Knudsen Co. Inc., last week received a \$22.4 million contract for construction of the USAF Titan 3 vertical integration building and solid motor assembly building (AW Apr. 5, p. 35), plus a connecting airlock tank and smaller support buildings.

Also last week, the post firm of B. B. Canaveral & Sons, Inc., and D. R. S. Contractors was awarded \$5.5 million to build 14 mi. of railroad track within NASA's Merritt Island Launch Area (MILA). Two spans, one from the MILA's industrial park and the other from the existing industrial building at Soudan Launch Complex, Ill., will connect with a rail line being built across the Indian River onto Merritt Island by the Florida East Coast Railroad.

American Bridge Div. of U. S. Steel has been selected to provide the steel framework of the 554-ft tall vertical assembly building in which the three-stage Saturn 3 and the five-man Apollo spacecraft will be mated and checked out. The contract was valued at \$24.5 million.

Brown Bros. has received a contract for 50 million to prepare the site of the vertical assembly building. Graham Dredging Corp. received \$17 million for fill and R. E. Clifton Construction Co. received \$1.5 million to construct foundations for Saturn 3 launchers. Aerial Lift Co. has been awarded a lump-sum contract to build a large unloading van over the vertical assembly building.

Holmes to Raytheon

Washington-D. Edward Holmes, director of the U. S. space agency's earth science Delta Gemini and Apollo moon and flight programs, will join the Raytheon Co., Lexington, Mass., on Oct. 1 to develop and manage new programs which he leaves the agency Sept. 30.

Holmes' assignment was first announced by James E. Webb, administrator of the National Aeronautics and Space Administration, on June 22 (AW June 17, p. 37). Although Webb's announcement and Holmes' departure were part of a planned reorganization following the completion of Project Mercury, it was known that the two had strong disagreements over policy.

Raytheon and Holmes' appointment was one of several changes introduced to strengthen senior management.

West German Talks Point to Mutual R&D

Franco-German research and development programs leading to advanced hardware projects for use by the military arm of the two countries during the near-term, including the supersonic VTOL aircraft, are expected to evolve from talks held here last week between U. S. Defense Secretary Robert McNamara and top German defense officials.

Specific agreement was reached on joint development of an advanced "area battle tank" while the VTOL program apparently was the subject of serious discussion but without any agreed being reached in its final details or a specific VTOL design.

Germany already has a test-bed version of a VTOL fighter in the MiG 19 (AW May 12, p. 76), although iterations from vertical to horizontal flight has not yet taken place. There are no plans at present to place the aircraft into production. Still, under a recent design, the new version of the YF101B question it would not be constructed and carried through the flight test stage in order to obtain further data.

West Germany, already, has an agreement with France, which has its own Dassault Mirage 70 program well under way, for the joint development of a supersonic VTOL aircraft and a similar joint work with Italy in a subsonic VISTOL aircraft, fighter, other than Mirage 6, that the U. S. could play in such a consortium appears to be one of the major issues under discussion.

One area might be within the armory field, with Germany, the U. S. and possibly France joining together for final design and development of a common rail rifle.

Extensive range reductions of the Mirage 19 in its present glide and maximum speed, have become a source of some concern in France's military planners.

Joint development programs with European North Atlantic Treaty Organization members have become a source of priority in one method of meeting continued U. S. satellite roles and participation in the military programs of West Europe (AW July 25, p. 64).

Scientific Cosmos Flights Resumed

Washington-Arrangement by Soviet Union that it launched Cosmos 19 on Aug. 6 at an inclination of 49 deg. into a 200-km orbit, has resumed the Russian launch of scientific satellites.

Soviets and Cosmos 19 was launched into an orbit with an apogee of 322 km, perigee of 177.07 km and period of 92.2 min. The spacecraft is transmitting on a frequency of 90.92 mc, the Russians said.

Cosmos 19 was launched on May 24 into a 52-day orbit (AW June 3, p. 33) and apparently was a Vostok-type spacecraft. The flight is believed by U. S. space officials to have been a check of various scientific and technical capabilities of the Vostok 5 and 6 between June 14 and June 19 (AW June 25, p. 51).

Soviet spacecraft launched in 45-day orbits are launched from Tyuratam, a rocket complex east of the Aral Sea for the launching of heavy rockets. Last launched in 40-day orbits apparently are smaller scientific satellites launched on one or more types of smaller rockets from Kapustin Yar, north of the Caspian Sea.

Soviet Union announced the Cosmos program in March, 1962, and said the purpose of the flights would be the study of charged particles in the ionosphere, detection and measurement of

magnetic fields, magnetic fields, ion concentrations and the earth's cloud cover, etc. The announced goals of the Cosmos flight program were stated by the Russians to be the evaluation of the effects of prolonged space flight on the human system.

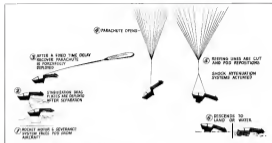
U. S., UK, Australia Plan Re-entry Study

U. S., Great Britain and Australia have announced they will conduct a joint basic research program aimed at identifying phenomena associated with reentry of bodies into the atmosphere, leading to improved identification and tracking of flights by missiles and space vehicles.

The effort, called Project Dasher, will utilize the Black Knight research missile of the British Royal Armaments Establishment. RAE will also design the reentry bodies to be carried by the Black Knight missile.

The reentry bodies will be carried into space by one stage and given as selected speeds for reentry by a second stage.

Launching will be made from the Woomera Range in Australia. U. S. Advanced Research Projects Agency will provide the instrumentation for observing reentry.



DRAWING SHOWS F-111 (TFX) pilot capsule ejection sequence from separation of the pod from the fuselage through ejection sequence.

Explosives Will Shear Pilot Pod From Fuselage in F-111 Escape

Pilot escape pod for the two-seat General Dynamics/Convair F-111 (TFX) fighter will be severed from the fuselage with explosives before being boosted away by a rocket, according to plans outlined last week by Air Force's Aeronautical Sciences Div., which is directing the project.

A bean-shaped capsule "exploding seat" will drop the crew compartment from the fuselage beginning forward of the instrument bulkhead, containing both the ejection seat and transmitting behind the pilot's seat (see drawing). A portion of the wing adjacent to the crew compartment also will be cut out

and left attached to the pod to provide stability during the escape.

Upon deployment of the shaped charge, a 10,000-lb thrust rocket motor will propel the pod away from the aircraft. Rocket Power, in developing the motor (AW 10/28 p. 27). All several ejection seats and provisions for environmental protection, including oxygen on-gas will be contained in the capsule.

Simultaneously with the firing of the shaped charge and rocket motor, the ejection control which initiates the ejection sequence will begin diagnosing tail shaft and switch on an emergency transmitter and flashing beacon to alert rescuers on the ground.

A small, dense parachute will be deployed first to decelerate and stabilize the pod. Then the main chute, similar to the one used in the McDonnell F-4 Phantom II, will be deployed (AW 10/28 p. 27). To reduce landing shock, the pod will be equipped by a parachute during a rocket jump, a shock absorbing material will be attached to the pod.

The system is designed to allow the crew to abandon the aircraft in any attitude and land on water. In the event the aircraft is ditched in the sea and sinks, the escape mechanism will automatically raise the crew compartment to a predetermined depth and the pod will rise to the surface and float, ASD says.

Two-Satellite Payload For Scout Planned

Washington—U.S. space agency will attempt to first launch the two satellites on a single Scout rocket late this year from the Pacific Missile Range.

National Aeronautics and Space Administration also said the launch would be the first attempt to place an air defense radar satellite in a polar orbit.

Properly a being managed by NASA's Langley Research Center, which has awarded a \$475,000 contract to the State University of Iowa to provide one of the satellites, an Air Force space-based reconnaissance instrument to detect and measure cosmic radiation emanating from the earth's upper atmosphere from space.

Langley will build the second satellite, which will be a 120-lb satellite sphere.

Purpose of the experiment is to study the effect of space radiation on the atmosphere. A new polar orbit was chosen because the earth's magnetic field causes energetic particles to penetrate more deeply in the polar regions and thus expose the spacecraft to maximum radiation flux.

Another YAT-28E

National Aeronautics and Space Administration's YAT-28E reconnaissance satellite will be modified to T-34 reconnaissance satellite under a contract previously awarded from Aeronautical Systems Div., Wright-Patterson AFB.

New modification is a contribution of the YAT-18E reconnaissance program (AW 10/1 p. 37).

DOD Seeks Disarmament Impact Ideas

By Philip J. Kim

Washington—Defense Dept. has invited industry to suggest ideas for ensuring disarmament that might result from arms control, if such an agreement is ever reached. The response to date has been slow, probably because few companies have yet made detailed studies of the problem.

The invitation was recently extended through the Defense Industry Advisory Council (DIAC) by Arthur W. Barker, deputy assistant secretary of Defense for arms control.

The program is part of a Kennedy Administration effort to explore the economic consequences of disarmament with industry and to develop plans for coping with the situation if the world should ever state. The Defense Dept. study was launched some months ago, prior to the start of negotiations for the recent limited nuclear test ban treaty. Similar studies are under way in other governmental departments with Dr. Walter W. Belles, Chairman of the President's Council of Economic Advisors, coordinating the multi-department effort.

In coping defense contractors to study the possible impact of arms control and international policy which could be taken in advance to ease the situation. Barker said DIAC, that they would be asked to show not only implications that an arms control agreement would be reached in the near future.

Because we analyze and plan for the impact of a disarmament treaty on our military and economic posture does not mean that we expect the outbreak of general war. For nuclear weapons, we should plan to live in cooperation with an arms control agreement," Barker said. The objective is to find out the economic consequences of coming to disarmament.

The Defense Dept. and the Arms Control and Disarmament Agency (ACDA) recently launched a joint study, known as Project Cloud, to learn far ahead about the possible impact of disarmament and, following an arms control agreement (AW 10/1 p. 32). The objective is to find out the economic consequences of coming to disarmament.

Four Suggestions

Barker acknowledged that industry, generally, has not devoted much effort previously to study the impact of arms control, and this explains why there have been relatively few suggestions advanced so far for meeting any military situation. Discussion in defense industry representatives, however, tended to center on current defense burden problems rather than on the problem which Barker is assigned to research, he indicated.

However, an aircraft company has approached the Defense Dept. to determine if, in order to develop into new defense area, it could use the present aircraft plant which it represents. Since this is a major of present aircraft plant production, he said.

He added, high-temperature structural steel and aluminum and structural materials can be used. High-temperature structural materials would permit the thermal stresses in a conventional reactor.

recommender inspection techniques and pitfall areas which disarmament and/or enforcement is impossible so that negotiation in any future arms control talks will be armed with such knowledge.

Recently, North America's Space and Information Systems Div. was selected from 15 bidders to be the prime contractor of Project Cloud Gap. Contract, covering the first six months of the study, is for \$200,000, with program funding expected to increase to several million dollars in Fiscal 1964. The Air Force Research Projects Agency (ARPA) is monitoring the project for the Defense Dept. and ACDA.

Although the detailed program for Project Cloud has not yet been approved, it is expected that a number of related field trials will be conducted to determine the effectiveness of various arms of available reconnaissance-suspicion techniques. For example, one objective is to determine the effectiveness of a small group of ground observers either on the ground or in a remotely located population, to detect an underground nuclear explosion, according to Vice Adm. Edward N. Parker, who leads the project at NSA.

Field Trials

Field trials also are contemplated to determine the ability to detect the presence of hidden fissile material, natural production facilities, and nuclear production and to perform effective arms reconnaissance when there is a conventional effort to hide military objectives.

The first field trial is expected to be conducted by the Army but is to determine effectiveness of qualified air forces in identifying mobile military equipment in "civilian" regions," both from the ground and low-flying aircraft.

Present plans call for ground reconnaissance of the field trials in order to verify satellite sensor equipment for what has previously been the computer.

Senior Chinese Air Force research, according to an old Soviet proposal for reconnaissance of the Sea of Japan, on opposite side of the Sea of Japan, which included the possibility of the approach, in a series of pioneering reconnaissance. How effective such reconnaissance pods would be and under what conditions, such as satellites in mobility and the accuracy of the sensors, is expected to be evaluated under Project Cloud Gap.

Barker says his office is anxious to receive any ideas responsive to the Defense Dept.'s request for specific suggestions to ease the impact of disarmament on arms control, providing they are submitted as working

Fast-Spectrum Reactors

General Electric's Nuclear Reactors and Propulsion Division is making fast-spectrum reactors for the Electric Propulsion Laboratory at Edwards AFB under a \$400,000 contract.

Fast-spectrum reactors are being developed for space applications nuclear reactors to be used for space propulsion because of their potential light weight and small size for a given power output.

Further advances between the fast spectrum and conventional reactors is that in the former, neutrons from the fissioning process are used directly without requiring a moderator to slow them.

He added, high-temperature structural steel and aluminum and structural materials can be used. High-temperature structural materials would permit the thermal stresses in a conventional reactor.



Navy Probe Measures Star Radiation

Spacetime instrument, called *Spacetime probe*, is shown mounted beneath the wing of a McDonnell F-101B. The payload instrument payload, developed by General Motors Defense Research Laboratories, consists of ultraviolet measuring device, measuring equipment and an attitude control system. The probe—first to be fired in the next few months—was launched on a single vertical altitude at 10,000 ft and reached an altitude of 16 mi. during Operation Nite Owl, a recent experiment to measure ultraviolet radiation from the sun. At peak altitude, the probe was about 90% of the earth's surface, 44,000,000 ft, as some have in the thousands of miles ultraviolet radiation from the sun, which is the source of the sun's energy. The *Spacetime probe* vehicle was dropped, built and launched by personnel at the Naval Missile Center, Ft. Meigs, Calif.

Atwood Calls 'Reputation' Best Incentive

New York—Incentive as a term is inherently contradictory has been given more weight than it deserves, in the opinion of J. L. Atwood, president of North American Aviation, though, as creating use of incentives in developing most contracts will unquestionably affect profits.

"I don't believe people are shrewd enough to diggle along at high speed and that the solution of a little incentive incentive will suddenly cause them to take off," he said. Reputation of a company and its contractual obligations will weigh much heavier in showing performance. Atwood told the New York Society of Security Analysts last week.

Profit levels, he said, continue to be a major issue in contract negotiations. But, in the case of the defensive North American contract for the Apollo lunar program that will be awarded, profit will be heavily decreased but was not unacceptable for the delay in reaching final agreement, Atwood said.

All major issues are involved in this contract, but the points still are being

negotiated. Data for the agency still is difficult to estimate, but Atwood said he was 95% sure probably that the document would be signed within a month.

Both sales and earnings of North American for the first nine months of its fiscal year ending Sept. 30—\$2.1 billion and \$25 million respectively—were down over last year's figures of \$1.1 billion and \$24 million, Atwood reported. He estimated that total sales would reach \$1.8 billion for the fiscal year and profits \$4.60-\$4.70 per common share, or about \$39 million, compared to \$14 million for fiscal 1962.

Despite the income in earnings, Atwood said, margins still are thin, as this he does not have as obvious as yet in what the profit margin for 1963 will be.

"Profit margins now are just over 2%," Atwood said, "and I think it might be possible to improve that somewhat. But it's hard when you're thinking of the overall company. We could improve margins for one or two years by shutting off the new or re-

search and development, but that would certainly be bad for the future of the company."

North American spent \$19 million as independent R & D in fiscal 1962, Atwood said, 14 times what it spent 10 years ago, and the company will spend approximately \$25 million this year. Some independent R & D costs are not reimbursed by the government. However, under contract changes in contracts.

Reflecting an industry trend, North American's capital spending continues to rise—from \$15 million last year to an estimated \$30 million for fiscal 1963. This supports the peak of North American's building program, and capital spending is increasing years should drop, Atwood added.

In this connection, United Aircraft Corp., preparing a \$42 million defense case offering this month, gave increasing costs for fixed assets in one of the reasons for the financing package, and said that it expected to spend \$75 million for fixed assets this year. Atwood adhered to the April price

and change in technology that he led to corresponding significant changes in the way industry is organized and does business. But he made no qualifications.

Too much emphasis has been placed upon the impact of change on the industry, and too little on industry's response. In one sense, the way we have not changed at North American is the same way that we are not changing by flexibility and adaptability. But in another sense we ourselves have been one of the factors bringing about change.

Other points covered by Atwood: • **Supersonic transport**—violated by North American and Boeing are under way in a Federal Aviation Agency-sponsored program, but the two companies have as agreement or understanding to be ready on any U.S. supersonic transport program. North American is taking part in helping to formulate a U.S. program, and Atwood declined to discuss the subject in much detail for the future. • **Little industry exists of any addition to the X-70 Mach 3 bomber program**, but Atwood held the technology passed would be under to North American and the nation as future program. Knowledge from that program enters North American's "most logical product" at the commercial supersonic transport. • **North American's Aerospace Division**, now its largest in terms of employment

F-1 Solution

Solution of the constant stability problem of the Rockwell 1.5 million lb. thrust F-1 engine engine for the F-105 5 year booster is a matter of design, according to J. L. Atwood, president of North American Aviation.

Goal of the successful F-1 program is to make the engine completely self-sufficient (AW May 15, p. 4). The engine's main problem is one of stability, including those caused by small or large changes in air in various areas of the engine during flight, as partly well as in heat, Atwood said.

But there is a question of how much weight should be added and how much time should be allowed to modify design phases of the problem.

Rockwell already has designed an engine that provides full engine thrust capability, but at a sacrifice in specific impulse. The design probably will be rejected, but research will continue on an engine that can meet both stability and specific impulse targets.

and so, will show some damage in the next year or two in the maintenance program, for which it provides guidance and flight control systems, plus at peak employment has been 10:15 at the State and Information Systems Division, which has the system program. Its projections of company data are expected to follow this trend.

French Navy Crusaders Will Have Boundary Layer Control on Flaps

Bullseye-Lap (Trans-Vigil) F-101 (FN) Crusader fighters to be used by the French Navy will incorporate boundary layer control on the flap and leading and trailing edges. "Vigilance" wing leading edge will also be incorporated, from the lower, lateral and leading trailing edge on the U.S. version, to 7 deg. on the U.S. Navy F-101. Blowing air through slots in the French version Crusaders and F-101, on which the Crusader will be based, requires the modifications.

French Navy is getting two quotations of Crusader, possibly being made by the U.S. Navy, which has awarded LTV a \$26,475,811 contract, with deliveries to begin next year.

Boundary layer control system will blow air bleed from the J79-32A-12 (revised) turbo-propeller engine over the flap and leading edge of the flap of approximately three pounds per square foot. Atwood said that the system will be re-characterized to be used in the future, as a gas system in the future.

Boundary layer control will be performed on a prototype French F-101 (FN). An additional F-101 (FN) will be used to evaluate installation of the French Navy aircraft system.

Admission and flap on French Crusader will have total deflection of 40 deg. in leading and trailing control. The flap will be used by the U.S. Navy F-101. Variable wing incidence will also be incorporated, from the lower, lateral and leading trailing edge on the U.S. version, to 7 deg. on the U.S. Navy F-101.

New wing leading edges will incorporate double control flap, as flap, have increased deflection from the U.S. Navy model. U.S. Navy F-101 Crusader leading edge flap has a 25 deg. deflection and the outboard panel 27 deg. On the outboard wing of the French Crusader, the forward section of the flap will deflect 15 deg. relative to the aft section and the aft section will have a drop of 8.9 deg. relative to the wing chord. The outboard wing leading edge flap will be deflected 15 deg. and 20 deg., respectively.

RLC and flap trim will be performed on a prototype French F-101 (FN). An additional F-101 (FN) will be used to evaluate installation of the French Navy aircraft system.

Piper Aircraft has begun production of its new 215 hp. Cherokee at the company's Vero Beach, Fla., plant. The plane received FAA certification last month.

Spacem 2 communications satellite successfully relayed telemetry data and photographs last week between Lagan, Nigeria and Lufkin, N. J. The satellite's gas jets are to be fired only this week to boost it to a 22,000 mi. synchronous orbit that will trace a figure-eight pattern 10 deg. north and south of the equator along the 55-deg. meridian.

Team 6 weather satellite, launched Sept. 10, 1962, has exceeded the 120-day mission of Team 5 for continuous operation. Team 6 has taken about 13,000 cloud cover pictures and last week helped out Hurricane Alvin.

Defense Dept. has issued a new "PERT Guide for Management Use," the second document issued on the program evaluation and review technique (PERT). The last one "PERT Cost Systems Design."

MU-2 Agreement

Mooney Aircraft Inc. has signed an agreement with Mitsubishi Heavy Industries to assemble the Japanese-made MU2 seven-place turbo-propeller transport plane (AW Apr. 1, p. 34) at Mooney's Knoxville, Tenn., factory and market and service it in the U.S., Canada and Mexico.

The MU2 is expected to be delivered to the U.S. in late 1964, and initial deliveries will be made by Mooney in 1965. Price of basic aircraft minus electronics will be about \$100,000.

Mitsubishi states that 70% of the MU2's production recently. It is a high-wing configuration, with retractable gear, 300-hp. turbopropellers. Maximum altitude is 18,750 ft.

The MU2 has a gross weight of 7,940 lb., and a payload capacity of 1,975 lb., with a 13 ft. x 5 ft. cargo bay, 12 ft. x 10 ft. and 12 ft. x 10 ft. Wing area is 187.9 sq. ft.

Crash speed of 20,000 ft. is 315 mph., rate of climb on two engines is 2,700 ft./min. and on three engines is 3,100 ft./min. Service ceiling on two engines is 15,000 ft. Takeoff distance over a 50-ft. obstacle at sea level, no wind, is 1,050 ft. Landing distance under the same conditions is 1,200 ft.

Maximum range, with auxiliary tanks, at 20,000 ft. is 1,750 mi. with a 30-min. reserve.



MICROMINIATURE CIRCUITRY... part of the big world of electronics at Boeing

Microminiature thin-film circuitry research is one of the many advanced areas of electronics activities at Boeing's Aero-Space Division.

Engineers in the Division's electronics techniques organization superimpose a series of film shapes as thin as 1/4,000,000th of an inch, to create a complete electronic network. A microcircuitization network, measuring 1/10" square, is shown magnified above, mounted on a header.

Boeing microminiature electronics capabilities include development of circuits on efficient transistor

claps, vacuum deposition of thin-film and mathematical analysis of circuits.

In all, more than 5,000 Aero-Space Division employees are engaged in electronics at Boeing, including design and production of ground-support and launch control systems for the Minuteman ICBM and airborne systems for the U. S. Air Force X-20 space glider.

BOEING
AERO SPACE DIVISION

PAA Sees Profit in Mystere 20 Service

By James R. Ashlock

New York—Paa American World Airways' entrance into the business aircraft distribution field, a move favored largely by Juan T. Trippé's personal interest in the venture, is based on the prospect of profits realized from supporting the aircraft through existing facilities (AW Aug. 5, p. 49) as well as sales or lease of the aircraft.

Although it expects to realize a net gain from leasing the Danish Mystere 20 executive jet, as from selling it outright from \$800,000 Paa American sees a longer range potential in servicing the aircraft.

Its initial order for 40 Mysteres, with options for 120 more, has enabled General Aerospace Corp. Miami Beach to program a production of 800 units. Paa American plans to equip its stations abroad for speeded service to Mystere sales, assuming that the aircraft will become popular as an executive airplane abroad.

Parts will be stocked at the stations, and facilities such as ground support equipment, flight planning, English, communications, maintenance and personnel for assistance with governmental formalities will be available. A credit arrangement to cover loss for such service will be established.

Trippé is himself a user of an executive aircraft, often flying in a modified two-engine Douglas B-25 of World War 2 vintage. The aircraft was acquired by a broker declared from the DG-1. Owned by Paa American, but carrying no official identification, the B-25 is now equipped with an executive interior, flown by a Paa American pilot, and based at Berlin Aviation's facilities at La Guardia airport. Trippé son is presently between New York and Washington, to do other Paa American activities.

Jet Market

His own experience with an executive aircraft could have led Trippé to the conviction that other corporations are ready to exchange existing private aircraft for jets, provided the airplane is proved safe and is operationally economical. Paa American itself is expected to acquire the B-25 for one of the Mystere 20s.

In the U. S., Pacific Aerospace and Berlin Aviation have been engaged in consultations with Paa American for the Mystere. Both firms will stock parts for the aircraft and conduct all maintenance and overhaul, also deriving from a parts machine, that General will establish here. Safe Flight Instrument Corp. will train crews for those leasing or buying the Mystere, using a flight simulator provided by Paa American.

Carver will pay approximately \$800,000 per aircraft to General, and will offer them for \$700,000 in this country, net including import duty and initial

overhauling. Paa American expects to receive at least 15 units in 1965 and the other 25 in 1966. General's production schedule calls for three aircraft a month, a rate that can be increased as orders arrive.

Paa American will pay \$75,000,000 for the delivery of the 140 Mystere it expects to sell in the U. S. plus \$35 million for the engine and U. S.-built communications and landing gear components specified for the aircraft. It expects to sell 20 Mysteres in Canada and an unspecified number in Latin America, while that Paa American estimates will net \$1 million.

Airframe Cost

Cost of individual airframes obtained from General will be \$525,000, while the U. S. components will cost another \$23,000.

Paa American's policy with the Mystere is somewhat different from that announced several years ago when it established its Business Jet Div. The Lockheed JetStar was then considered

in the airplane to buy. The plan then was to offer corporations a lease package, whereby Paa American would provide crews and service along with the aircraft. Corporations were among pilots of such on corporate parties, many of whom were also connected with firms providing the maintenance on existing executive aircraft fleets. The program was eventually abandoned when the military cancelled orders for the jetStar, leaving prospective buyers faced with having to cover the research and development costs.

No Consideration

Paa American officials say that since that time, there has been no serious consideration of entering the business jet field in anything other than a sale to the lease basis. However, a pilot would be required, they say, because of the complexities involved in drawing contracts specifically tailored to cover the individual characteristics of executive pilot fleets.

Alvin F. Adams, vice president of Paa American, said that the Mystere 20 was selected principally because of its cargo and performance in light of its purchase price. The aircraft lacked all of the executive class jets now available or under development, with the de Havilland DHC-125 ranking as the second choice.

Mystere 20 has a 1,500-hp. engine capable of 1,600 hp, a maximum 10 per cent out of its 22,700-lb. gross weight. It can cruise at 540 mph, and Adams said its average runway requirement for takeoff and landing is 4,100 ft.

Hughes Tool Co. Drops Northeast Support

New York—Expected withdrawal of Hughes Tool Co. from its agreement to create Northeast Aircraft operating cash deficits (AW July 6, p. 36) came last week before the Civil Aeronautics Board's vote concerning North's financial crisis.

Notice of the withdrawal was in a letter to James W. Austin, Northeast's president from Raymond M. Holliday, executive vice president of Hughes Tool.

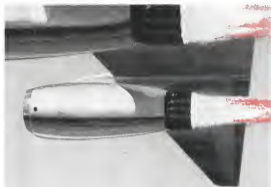
The agreement to create the operating deficit was made by Hughes Tool in June 1962. Among the reasons listed by Holliday for canceling the agreement was the \$21-million already received by Hughes Tool through direct loans and guarantees, and "the inherent uncertainty of profiting the enterprise" of efforts to obtain a CAR recommendation.

Holliday said, however, that Hughes Tool would implement a \$4-million loan through the Civil Aeronautics Board in mid-1963. The amount of a whole renewal of a 10-million loan (last established in 1962) since Hughes Tool obtained CAR approval to back Northeast's financial crisis.

The tool company would also consider future financial support of Northeast, should some merger proposal arise that would be approved by the CAR, Holliday added.

Hughes Tool officials said that efforts would continue toward a merger of Northeast, hoping that the CAR might overcome its doubts about a merger be attained.

Negotiations have been associated with two other current bidders: Trans World Airlines. Northeast Airlines was one of the two. Cashed-out Air Lines is known to be interested in discussing merger with some carrier, but any consideration it would give Northeast would probably be conditioned on the CAR granting the merged company not only a permanent Florida route, but also New York-Chicago rights.



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Italians Protest Indian Accident Report

New York—Italy's Ministry of Transportation and Civil Aviation has protested the opinion of an Indian investigation team that pilot error was the cause of an Airbus DC-8 crash near Bombay on July 6, 1982. Eighty-five passengers and crew members died in the accident.

The Italian ministry refused to sign the Indian report and says it will submit its own findings on the accident to the International Civil Aviation Organization.

An traffic controller at Bombay's Santa Cruz airport was cleared of any blame in the investigation report. However, Indian officials insist that the pilot, Captain Luigi Quattrone, was given erroneous instructions which caused a premature descent into a mountain top.

The aircraft was on a flight from Sydney to Rome, with stops at Bangkok and Bombay. It was approaching Bombay at night through heavy clouds and rain, characteristic of the monsoon season.

The report asserted that the pilot's error in navigation caused him to believe he was near his destination, thus he actually was. He therefore descended the aircraft prematurely, it said, as instrument conditions for a straight-in approach had not adequately cleared this high terrain.

"The controller stated that the instructions connected with the accident have been found to be the pilot's failure to use the navigational facilities available to ascertain the correct position of the aircraft, mismanagement of the prescribed instrument, rate altitude of 5,000 ft., and nonobservance of the pilot with the terrain on the route," the report said.

The Indian point of this opinion came after the Indian government had accepted the investigation report. All four members of the investigation team

endorsed the findings.

The Italian claim that Cape Dutton descended to 4,000 ft. on instructions from tower personnel, and that voice recordings prove he did so only after the tower affirmed his question as to whether radio contact had been made.

"The Airbus captain, in fact, received instructions from the control tower to descend to an altitude of 4,000 ft. while on the route there exists an obstacle of 5,000 ft., and while the air route flight rules for the area described the minimum safe altitude as 6,400 ft.," the Italian protest read.

The Italians claim that the team in charge of approach control was not even at his station when the Airbus jet was approaching Bombay, and that the instructions were being given by a controller responsible only for traffic within the airport pattern.

"Modifications recently introduced by the Indian air authorities for the approach to the Bombay airport confirm the validity of what is being affirmed by the Italian airline," the protest read.

The modifications referred to prohibit an aircraft's descent, during instrument conditions, below prescribed levels until approach conditions confirm by radar that it is within a 25-nm radius of the airport.

"It is impossible to accept the report that the clearance given to the aircraft would enable the pilot to descend to 4,000 ft. at any stage outside the limit of a 25-nm radius of Bombay airport," the investigation report said.

"It must, therefore, be held that the clearance was in error," the report continued, "was not ambiguous and was intended to apply only to the vicinity of Bombay airport within a radius of 25 nm, and that it was understood so much by the pilot himself."

"The pilot was sufficiently experienced to ask for clarification if he had not understood the clearance or to report it if he had found it unsuitable in any way."

The report indicated that Bombay controllers expect pilots to be familiar with the surrounding terrain, and that the responsibility for meeting terrain clearance rests with the pilot.

"However, it does appear that there is an impression among some pilots, possibly held to make and other operational procedures, that the clearance issued by air traffic control at any time would take them into consideration," the report said. "Such an impression is a dangerous one and can lead to serious consequences."

The Indians rebuffed Alitalia's charges of improper procedures by the traffic controllers, saying that "the impression must against their veracity and value and deserve to be rejected."

Pakistan Carrier Sees Profit in Fiscal 1984

New York — Pakistan International Airlines is predicting that it can absorb the losses of its planned helicopter operations in East Pakistan (AW June 8, 1982, p. 41) and still make a \$2,750,000 profit in fiscal 1984.

Expense of the helicopter service is expected to take only half of the anticipated difference between revenues and costs. The carrier's outlook for increasing revenues of \$40,441,000 for the year against expenditures of \$36,587,000 for fixed-wing operations.

The airline, which operates without government subsidy, has qualified its optimism during its five years of operation, having recorded total revenues of only \$22,158,000 in fiscal 1979.

Increased revenues are anticipated during the coming year from expanded services, which will include the carrier's first service to Japan and an increase from four to five in weekly flights to Europe. In the fiscal year just ended, the Pakistan airline earned a net profit of \$1,425,000.

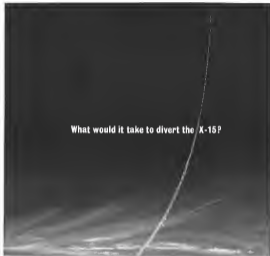
CAB Reaffirms Credit Plan Decision

Washington—Civil Aeronautics Board last week reaffirmed its decision that when most pay credits on deposits made under the Universal Air Travel Plan (AW Jan. 28, p. 35), but agreed to accept the case to determine whether a varying interest rate should be substituted for the uniform 5% provided by the Board.

In petitions for reconsideration, airlines held that high-volume users of transportation have used more transportation than they have paid for in advance through the deposit, and hence, have no deposit with the carrier at any time. These airlines, the airlines argued, receive the same 5% interest rate as individuals who, in effect, do have a deposit at transportation used in less than the amount of the standard 50% deposit required for each service.

Travelers thus concluded that a variable interest rate applied to deposits without regard for transportation used and the length of time the deposit has been on hand would create the discrimination between high and low volume users which the Board attempted to eliminate.

In last week's order, the Board noted it would not reverse its decision that, if the deposit is not eliminated, interest for the 12 months beginning Jan. 1, 1983, must be paid. It added, however, that the rate should be accepted on the issue of whether the uniform interest rate should be substituted by "a replacement that would take account of possible differences in the positions of various depositors."



What would it take to divert the X-15?

But that isn't even his job with the naked eye could throw the X-15 "out of the loop" true line of its soaring flight. Let these microscope pictures look in one of the extremely fine tolerance surfaces or surfaces of the hydraulically operated flight control systems—and things begin to happen! The trouble is, this would be happening at an immense 4,000-psi-plus that converts the slightest error or misalignment into enormous errors in actual flight path.

This problem of maintaining hydraulic systems purity was solved in the early days of the X-15's development by installing two specially designed Purolator Elements. Of course, design in weight-saving aluminum, these filters remove 100% of all particles 20-microns or larger. The elements are of stainless steel—resistant to corrosion—capable of functioning efficiently through a -40°F to +300°F temperature range.

Purolator's extensive design and development of the X-15 high pressure hydraulic filters has been one of its many contributions to aerospace progress. Purolator filters have helped solve filtration problems for virtually every type of aerospace and ground support equipment produced by the aerospace industry. For more information in terms of your filtration needs, write today. No obligation. . . and we'll send you a copy of Purolator's new quarterly publication "Aerospace Filtration". It's packed with features and articles of particular interest to companies active in the aerospace industry.

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This is Purolator's Filter G-4125. Each filter element about 5 1/2" long. It has a capillary design which provides 100% filtration of particles 20 microns and larger and 90% filtration of all contaminants as fine as 10 microns. Designed for 2000 psi operating pressure, it has a minimum differential pressure of 40 psi and a rated safe working pressure of 4000 psi.

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Boeing Rolls Out First 727 for Eastern

First Boeing 727 designed short-to-medium range transport for Eastern Air Lines has been rolled out at Boeing's Renton, Wash., facility. Eastern has ordered 40 of the aircraft, which will be placed into service to about 19 cities on the carrier's routes beginning next year. Deliveries will start late this year. Total of 727 orders now stands at 171 aircraft for seven airlines.

First Reports Indicate Substantial Six-Month Profit for Trunklines

Washington—First reports from six major airlines for the first half of 1963 indicate that the industry will show substantial earnings gains for the period compared with the first six months of 1962. Both National Airlines and Delta Air Lines have reported record profits for the first six months ending June 30.

Delta reported a net income of \$13.8 million for the first six months, equal to \$5.42 a share, compared with \$6.9 million, or \$2.74 a share last year. The 1963 net income included no profits from equipment sales. That source accounted for profits of \$1.3 million in the previous year's report.

Norfolk's net profit for the first six months was \$9.2 million, compared with net earnings of \$4.2 million in Fiscal 1962.

Operating Revenues

Nationally operating revenues for the year rose to \$109.4 million, compared with \$108.5 million in the previous year. Delta's operating revenues climbed 24%, from \$106.7 million in Fiscal 1962 to \$132.0 million this year.

For the first six months of calendar year 1963, Northwest Airlines reported a net profit of \$1.4 million as total operating revenues of \$71 million. This compares with a \$1.6 million net profit in the like period of 1962 on total operating revenues of \$71 million.

Western Air Lines' profits for the first six months of the year totaled \$1.5 million as the airline company high first

six-month period. Net profit was \$5.3 million, or \$2.71 per share, compared with \$3.5 million, or \$1.39 per share last year. Operating revenues for the six-month period were \$45.8 million, compared with \$41.4 million in the same period last year.

Western attributed the favorable results in part to traffic generated by the secondary Thriftair service between Los Angeles and San Francisco. The service is averaging some 1,100 passengers per day, according to the airline.

Western also reported that the bank-owned carrier for the six-month period ran 41.1%, compared with 47.5% last year. The carrier said that the slight drop in return last year to 55.5% from 56.6% was offset by the reduced bank-owned load factor, which increased the profit margin from 6% to 10.4%.

Trans World Airlines showed significant improvement for the first six months in earnings last year's second-half of \$12.5 million to \$4.5 million in the 1963 period. Total revenues for the period rose from \$185.1 million in 1962 to \$216.4 million this year. The airline's second quarter net earnings totaled \$5.7 million, due to record fare revenues that resulted in net earnings of \$7.3 million for the month.

Continental Air Lines earned \$1.4 million, or \$1 cents a share, in the first half of 1963, compared with \$156,000, at 13 cents a share, in the same 1962 period. Operating revenues for the pe-

riod were \$16.9 million compared with \$11.5 million in the first half of 1962. Bonifant Airways reported a \$11,041 net profit, a drop from the \$1.6 million gain reported for the first six months of last year.

Net earnings of \$163,958 in the second quarter of the year reflect losses reported in the first quarter to produce the six-month profit.

Among the international carriers, Pan American World Airways reported a net profit of \$4.7 million, at 71 cents per share, for the first six months of the year. This compares with a net loss of \$756,000 reported for last year's six-month period. Second quarter earnings were \$6.9 million.

Fuel Use Improvement

The Air and the improvement in earnings "reflects a 10% reduction in fuel costs." Operating revenues during the first half of 1963 rose \$25.8 million, an increase of 13.1% over the corresponding period of 1962, but the rise in operating expenses was held to 7.7%.

Second World Airlines reported a \$52,015 net loss for the first six months, compared with last year's \$754,541 loss. Revenues rose from \$16.6 million in the first six months of 1962 to \$12.5 million for the 1963 first half.

For the first six months of the year, Pricer-Tiger Line reported a loss of \$53,142, after provision for a federal income tax credit of \$975,000. Revenues for the period were \$192 million, compared to last year's gross revenues of \$25 million which brought a net income of \$1 million. The airline reported a net profit of \$447,000 for the second quarter of 1963.



Vertical assault at 200 mph

Sikorsky's new CH-53A transport helicopter will be big, fast, and tough. It will provide the U.S. Marine Corps with its first all-weather, all-climate helicopter for vertical assault missions.

The powerful CH-53A will speed 36 troops or 5,000 pounds of cargo 135 miles at 170 mph—and return without refueling. On short missions it will transport 44 men or 16,000 pounds. It will carry a Pinking missile, 155 mm howitzer, or three-quarter ton truck. It will operate

from any terrain and offers a watertight hull for emergency flotation. Under light-load conditions, top speed will exceed 200 mph.

An advanced rear-loading cargo system will permit one man to load a ton a minute. Front-loading cargo can be picked up in flight without a ground crew.

The CH-53A is based on the proven technology of Sikorsky's twin-engine S-64 Skyraider. First flight is scheduled for 1964.

Sikorsky Aircraft

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Cape Cod Taxi Offers Trunk-Type Service

Provincetown — Operating within Cape Ann's historic-based jurisdiction governing air taxi services, Provincetown-Boston Airline has developed into a carrier growing \$500,000 a year and offering practically every aircraft affected by a major trunk line.

Cape's multi-engine fleet consists of two 1916-model Lockheed Electras, two Cessna 441s and a Piper Apache, supported by several single-engine aircraft which are also used in scheduled service when needed.

"To my knowledge, we're the only air taxi operation in the country that flies the full program including scheduled passenger service, seasonal seats, mail and express," said John Van Andile, president of the airline.

One exception is food and beverage service, but it is hardly significant, noting that the largest scheduled route segment—a 45 mi. leg, or about 20 mi. flying time.

However, this compares with 120 load miles that require three hours of driving between Boston and the half-day return and arrival delays at the tip of Cape Cod. In 1962, the air service attracted 18,254 passengers at \$3 a head, with about 70% of the volume being interstate connections from New York-Boston flights.

Cash Exchange

There is a big cash exchange between Van Andile's airline and the big interstate operation, mainly because they all tickets on one another and Provincetown-Boston Airline is authorized to issue Air Travel Plan credit cards. In 1962, Van Andile paid the airline for \$75,000, and received \$90,000 in return payments.

"We're primarily a seasonal operation," Van Andile said, "and things really drop off around here during the winter."

Seasonal aspect is the reason why Provincetown-Boston Airline is a member of the northern division of a two-company operation, which is the winter business Naples Airlines. When the Naples line Provincetown, Van Andile takes his airplanes and 18 employees to Naples, Fla., where they run 12 other airplanes in providing scheduled service between that city and Miami.

Provincetown-Boston route takes its most activity on the annual legions of May to Sept. 30, in which 90% of its yearly volume is realized. Weekly figures show the impact. Between July 17 this year, 539 persons were carried. From Jan. 24, eight were recorded.

"We always have one single-engine airplane and a pilot in each city during

the respective winter, just to take care of whatever business comes along and to maintain our identity," he said.

"The Naples-Miami business isn't as great as that of Provincetown-Boston," he added, "but it is satisfactory, providing 4,000-5,000 passengers in 1962."

Van Andile's philosophy toward air operations involves close attention to the valid factors—cost control, operation personnel and equipment utilization, and an awareness of the danger of becoming too big.

His multi-engine and substantial credit policy net him a profit, but she help out with the usual personal duties. Van Andile's 35-year-old son has his commercial rating and is handling an on-airplane flight. Mrs. Betty Van Andile, the president's wife, runs the books and even runs the ticket office in Provincetown one day a week.

Van Andile also operates as a device services such as charters, also scheduled as far as scheduling. Scheduled base operations at Provincetown and Naples, with the airport bases.

At Naples, the airline has a contract with the Gulf American Land Corp. to be prospective buyers over developed land sites. Van Andile has eight Cessna 173s connected to the operation, and eight pilots. Last year he flew 61,100 persons under this contract, operating in many in 113 flights in a single day.

Leased 880s

New York's Cape Cod 600 aircraft on base in Northeast Airline down the General Dynamics Corp., are being purchased by Trans World Airline.

Although financial arrangements for purchase of the airplanes and support are still being completed, two of the 880s have already been delivered to TWA's maintenance base at Kansas City, Missouri, is expected to receive the other two in mid-September.

General Dynamics demonstrated earlier that the 880s be acquired because Northeast ran 342 Electras in last year's season (AW July 24, p. 40). General Electric was also the 513th aircraft on base of the aircraft C-47s on.

General Electric is selling the dependent regions in General Dynamics, and TWA will purchase both aircraft and engines in a single package. No type engines are involved. TWA already has taken for its 40,000 2000 Cessna pilot.

Northeast will continue jet operations with four 1100 cubic ft in existing stockpile, Hughes Tool Co.

His night-time airplane at Provincetown is a Boeing 55MA built in 1931, able to carry four persons besides the pilot. It has run approximately 5,000 person per \$1.50 for a 15 minute look at Cape Cod's tip.

In 1961, Van Andile's charter business topped scheduled service revenues by \$1,000. However, a mean charter contract was discontinued in 1962, and charter revenues totaled 80% of those island-based scheduled service. President Kennedy's family at Hyannis Port are frequent users of the charter service.

Operating without a CAA certificate and without a CAA certificate, Provincetown-Boston Airline is limited by Part 135 of the Civil Aeronautics Act, which prohibits use of aircraft exceeding 12,500 lb. gross weight. The airline's fleet is gone at 80,000.

"Under this situation, these Lockheed Electras are the best aircraft for our operation," said Van Andile. "The empty weight is only 7,500 lb., and the empty weight is only 10,000 lb. plus 150 lb. of baggage in the one and 250 lb. in each wing compartment."

Full Payload

There's no problem in putting a full payload on the Lockheed, since fuel is a major weight consideration. They need only 65 gal. for the round trip to Boston. The Lockheed operates at about 35 miles a hour, pushing a one-passenger's approximately 100 mi.

One of Van Andile's Lockheed is a 10A, with Pratt & Whitney 555 propellers, producing 450 hp. The airline is a 10A, with Pratt & Whitney 555 propellers, producing 450 hp. The airline is a 10A, with Pratt & Whitney 555 propellers, producing 450 hp.

"We fly visual flight rules almost exclusively, being certified to go down to 500 ft. altitude," Van Andile said. "Consequently, we need only one pilot, and can even sell the cockpit's seat to a passenger if necessary."

Four airplanes a day are offered between Provincetown and Boston, with seasonal service on Friday and Sunday evenings when peaks are highest. On Friday, a shuttle service is initiated to handle the volume of seasonal weekend traffic in Provincetown. At Naples, three flights a day are operated year-round, here being 513 24 to Miami. Resing is the multi-engine aircraft takes care of the summer months with one-engine aircraft.

Van Andile recently installed an air taxi service available to 37 New England communities for flights into Boston's Logan Airport.

Charles J. Conner, 412, and a Piper Apache, the taxi is available upon phone request.

AIRLINE OBSERVER

► **National Aeronautics and Space Administration's** Manned Spacecraft Center at Houston is already a major airline customer, having spent \$1.7 million during fiscal 1963 to send employees to space contractors and test and development sites throughout the country. MSC recently has about 1,000 employees, and expects the total to level off at about 5,000 under current program. In addition to NASA personnel visits, the center contracts with 700 industry personnel and MSC, mostly from various parts of the country.

► **Standardization of equipment** is a major goal by Northwest Airlines for the rest of its fleet Douglas DC-8 aircraft. Northwest will have Northwest with an all-Douglas fleet. Current aircraft has 12 Boeing 747s and three 767s, with two more 747s on order. Officials and some Boeing would be ordered to replace the DC-8s. Four of the old aircraft are going to National Airlines, and one to the independent French carrier Union Aeronautique de Transport. L. H. Moring, Jr., president of National and the DC-8 purchase would be limited without additional financing. Northwest has its DC-8s up for sale for two years (AW May 5, 1961, p. 35).

► **Seaboard World Airlines** has reached an agreement with Canadian Ltd. extending terms of payment of \$10.6 million it owes the manufacturer. Refinancing did not involve the structure of any equity securities, and the airline states it can meet operating schedules out of charges for de-maintenance and maintenance. Under the plan, Seaboard will pay Canadian \$3.1 million in 1963, \$5.5 million in 1964, \$2.9 million in 1965 and \$28.0 million in 1966 to meet the debt.

► **United Air Lines** will convert 14 more Boeing 720 transports to standard service configurations this fall as single-class airplanes are expanded to 15 more seats. United will place 21 of United's 26 Boeing 720s in standard service. Also planned is conversion of some Douglas DC-8 transports to standard service next spring. Schedule expansion includes introduction of one-class service between Chicago and Los Angeles, where the concept will receive a big test against the multiplicity of fares already in effect on that route. With the expansion, United will be offering 71 daily one-class flights, compared with 30 now.

► **Boeing's** Aerobus for the first time has released break-even load factors on several transports. TU104B, 100 passenger twin jet, breaks even with 66 passengers on the Moscow-Tokyo route and, between Nurek and Moscow, the plane's load-even point is 65 passengers. B-16 transport requires 71 passengers to break even on the Leningrad-Istanbul route and the A-10 transport needs 71 passengers. In the latter case, Boeing is forecasting it is possible that the plane in the high-density version carrying 100 passengers.

► **As Low Pilot** has just work signed an agreement with United Air Lines that combines the services of the merged United-Capital company, provides for a jet crew complement of a minimum three pilots and first officers to give optimum jet service as well as \$14,000 monthly, costed at high as \$28,244 per year and second officers at high as \$17,484. Contract also brought improvements in rates, working conditions and pensions.

► **Airline** has ordered five additional Canadair transports for delivery next spring. Order brings the Italian owner's Canadair fleet to 15 aircraft and San Antonio's Canadair backlog order to 173.

► **Domestic** trucking common stocks are becoming broad issues on Wall Street. Stocks which set in during the opening months of the year have been recovered by the recent surge of popularity, and most airline listings are being sold at prices at least 10% above 1963 levels. Last week, some airline stocks dipped slightly as a result of profit-taking, but continued reports of public, traffic growth and equipment expansion programs are expected to boost the upward trend. Last week, Pan American's stock, after its purchase of 40 Boeing 747 jet transport aircraft was announced (AW Aug. 5, p. 40).

SHORTLINES

► **British European Airways** has purchased two Sikorski S-61N helicopters for operation between Land's End and the Scilly Isles, the shortest route on the island's system. Helicopters, which cost \$2.1 million with spares, will replace the four passenger de Havilland Rapide biplanes currently shuttling daily between the two points.

► **Civil Aeronautics Board** has ruled that its investigations into jet accidents on the North Atlantic should be closed to the public and proceedings kept confidential.

► **Federal Aviation Agency** will conduct a series of meetings during the next two months with aviation manufacturers to discuss some of modernizing certification requirements of aircraft. Total of 11 meetings are scheduled at points throughout the U.S.

► **Florida Air Lines** of Spain has inaugurated Douglas DC-8 scheduled transport service on its route from Madrid to Caracas via the Canary Islands. Flights initially are scheduled once a week, and bring the total of transatlantic flights operated by Iberia to 24 each week.

► **Irish International Airlines** reported a load factor of 53.5% for the second quarter of 1963. The airline said this was the highest load factor of all 14 IATA carriers flying between the U.S. and Europe.

► **Pacific Southwest Airlines** closed 1963 fiscal year at \$1.41 million, or 51% above 1962, on the same period ended June 30, 1963, up 54% over the \$485,000, or 35 cents a share, reported for the first half of 1962. The airline's industry comes also and first revenue and passenger bookings in July were the highest of any month in the company's history.

► **Sabena Belgium World Airlines** has reported a 50% increase in cargo traffic on its North Atlantic route for the first six months of 1963 compared with the same period last year.

► **Trans World Airlines** President Charles D. Tillgham, Jr. has warned that unless U.S. airlines see a "pretty tight" domestic expensive transport program, they'll have no choice but to let the Canadair transport under development by a French-British combine.

► **United Air Lines** has added Red Carpet Room for use by members of the airline's 193,000 Mile Club to the Chicago and Honolulu airport terminals.

Mr. Couillard, just what is the Universal Radio Group?



Lee Couillard, President of U. R. G. Inc., Chairman of the Board, and Vice President of the U. R. G. Inc. is shown in the new approach to U. R. G. Inc. advertisement.

Q Universal Radio Group. That sounds like an all-purpose phrase. What does it mean?

A Collins URG is a complete family of 100 equipment using the latest design techniques and components in a building block arrangement to provide maximum versatility to meet modern communication requirements. Add to this the latest equipment possible and you have URG.

Q You say that versatility is gained by selecting components. Doesn't that tend to make the URG a rather large, bulky unit?

A Not only. These components are the so-called "brick box" type with plug-in modules or circuit cards. This packaging concept makes the URG as easily well suited to mobile, transportable, shipboard and airborne applications as it does to fixed station.

Q What are the basic components added in the Universal Radio Group?

A As you know, any communication network needs a transmitter, re-

ceiver, control system and antenna. And these are all a part of the Universal Radio Group. The URG components have been referring to, however, are receiver, antenna, receiver-control and power supplies and are added to provide the basic communication functions according to the communication needs, resulting in maximum versatility.

Q Can you give us an example of what you mean by maximum versatility?

A Let's say that a standard requirement existed for ground-station, upper sideband, 1 kc bandwidth and 1 kc tuning increments. The URG entity with an automatic power amplifier was selected to satisfy the requirements. The station antenna is changed, and you find a requirement for point-to-point, 12 kc bandwidth, and 100 cycle tuning increments now exist. Rather than replace your transmitter group completely, you simply add circuit cards to the URG receiver and your antenna system is modified. The versatility is provided in the receiver as well as the antenna.

Q Does the URG offer a choice of output power levels for use in transmitter configurations for a variety of communication circuits?

A Yes. Automatically tuned power amplifiers to meet a wide variety of requirements are available in four basic output levels: 1 kw, 25 kw, 10 kw and 45 kw. All are compatible with the URG receiver and receiver control.

Q What are the advantages of automatic tuning?

A One advantage is minimum operator tuning requirements. Even unskilled personnel can be taught to operate URG equipment in a matter of minutes. A second feature of importance is military application of importance in military operations is operation in an ECM environment. URG equipment receiver frequency can be changed in less than five seconds, and transmission can be turned up ready for operation in less than 20 seconds. Also, equipment reliability is increased since even a slight error in tuning adjustment can subject components and circuits to stresses that decrease

component life. Automatic tuning is valuable in allowing remote control, ensuring operation adjustment at all times.

Q Since the URG equipment operates on single additional, is it compatible with other systems which do not have a high degree of ambiguity?

A Yes. One of the features that contribute to the excellent efficiency of Collins URG equipment is the fact that receiver filters have extremely sharp selectivity characteristics. Effectively, however, it is some times necessary to receive signals from transmitters that do not have a high degree of frequency stability. In such cases, to prevent the signal from being unusable, we have included a system of optional automatic frequency control and pilot carrier. In addition, the receiver and antenna may be provided with an optional selectable AM mode if you should require this feature.

Q Are URG components and equipment available in production quantities?

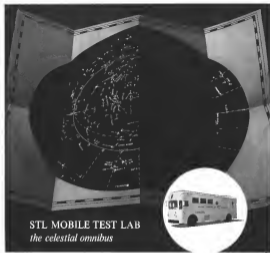
A Yes. The URG is currently in full scale production and is available to off-the-shelf equipment. It is presently available operation in 1000 units in NATO's communication system, in marine tracking system and other service operations in the U.S. and around the world.



If you have other questions on the Collins Universal Radio Group or wish further information on what the URG can do for you, write today for your URG Engineering Reference File.

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STL MOBILE TEST LAB the celestial omnibus

When a spacecraft orbits as many as 50 experiments as a satellite, it demands ground support equipment with broad capabilities to chain its course. Mobile Test Labs, designed and built by STL's Space Technology Laboratories via satellite, receive, record and evaluate 64,000 bits of telemetry data each second. Operating under manual, semi-automatic, or completely automatic control, these vehicles orbit the telemetry data for on-line testing and monitoring of spacecraft electronic systems during integration, assembly and pre-launch test. STL scientists and engineers are using this equipment to test NASA's Orbiting Geophysical Observatory (OGO), Air Force-ARPA 423 geospatial, and other classified vehicles.



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program. ONERA also acts as the field of space satellites.

• **Commissariat à l'Energie Atomique.** France's major exponent of the Atomic Energy Commission in the U.S., which is working at the area of nuclear propulsion techniques with space applications.

• **Société pour l'Etude et la Recherche d'Energie Balistique (SEREB).** an industry consortium developing France's IRBM as well as the Dauphin space booster series. Member firms are Nord Aviation, Sud Aviation, SNECMA, ONERA, Dassault, MATRA and SEPR (Société d'Etude de la Propulsion par Reaction).

• **Centre National de la Recherche Scientifique,** which is active in high speed plane research, using both balloons and research rockets primarily for the collection of meteorological data.

• **Direction de la Météorologie Nationale,** also active in high atmosphere research, using in-house developed and inexpensive meteorological rockets that can reach an altitude of approximately 50 mi. The government agency also is developing electronic packages for inclusion in the rocket's nose cone plus a new steel thrust package for recovery use. The package is designed to be effective in very low atmospheric conditions. The research rocket developed by the agency is slightly less than 10 ft. in length and can carry a 4.4 lb. payload. Total weight of the package is 133 lb.

• **Office National d'Etudes et de Recherches Aéronautiques** which is currently planning an expansion to increase with growing the intensity of infrared radiation on several wavelengths along the horizon. Experiment is scheduled to be conducted from the aircraft's payload of sounding balloons will be altitudes of between 60 and 120 mi.

• **Centre d'Enseignement et de Recherches de Médecine Aéronautique** charged with studying the human aspect of space, plans to launch a rocket along a ballistic trajectory sometime next year in the case of a Venus mission rocket developed by the Direction des Etudes et Recherches d'Armement by the Laboratoire de Recherches Balistiques et Aérodynamiques. A second and larger ballistic trajectory launch of a rocket may be made with Dauphin 2 in 1985 if the first test goes successful.

Airtest Launches

A test will be launched into a sub-orbital trajectory later this year in the case of a Venera-type research rocket.

Venera, developed by Sud Aviation, was used last October to fly two men of the Venera mission in upper atmosphere balloons. France at this time is covered after a 70-sec. flight, but the

second launch is an infeasible one and could not be retrieved.

Each was fitted with a series of electronic attached to the nose and other major areas, and the ambient data was transmitted to the ground.

Despite these requirements, CNES president Jean Cousteau says France's national program has no aim for a major program in such. Other officials say the country eventually might be interested in participating in a European-wide manned space program, should one come about, although other contend that, even on a multi-lateral basis, budget considerations probably would preclude any attempt that could begin to approach the scientific terms of the accomplishments already achieved by the U.S. and the Soviet Union in the field.

Advanced Programs

In other areas, however, France is peering ahead. Development well beyond the current needs of an national space projects in order to assure that a leading role is potential, advanced intra-European programs of the future.

In the nuclear area, the CNES proposals to the government say that studies of both nuclear propulsion for air, orbital, orbital, orbital systems could be added to a top priority list under the direction of the Commissariat à l'Energie Atomique.

Actual hardware, if any, probably would require substantial financing, and CNES admits that development of a nuclear reactor for propulsion "would possibly exceed the national capability." As space expert adds, however, that "the government" should be given to a study of "the difficulties which must be overcome, to calculate the cost and duration of a development program and to estimate the performance that can be achieved." It appears a matter of agency to assemble the determining factors concerning no clear propulsion in order to clarify ideas on an international basis.

The French says France should consider thermal nuclear propulsion for potential use as a first stage booster and the applications as an auxiliary source that could power a vehicle to reach its space range after it already has been placed in a low earth orbit.

In the field of nuclear nuclear power for satellites, CNES says that to date "it is impossible to decide between the fundamental technical approach that exist," including a choice between ionosphere and plutonium as a power source, and wants that to be decided now. In covering the American and Soviet programs without the hope of avoiding certain developments which already

have become apparent in the chosen made for Ship (System for Nuclear Auxiliary Power).

CNES says a 2.5 year study should proceed immediately to the basic approach that should be taken, particularly if it incorporates such France already has undertaken on the use of plutonium as a direct use source of nuclear energy to power. After that step, CNES says, a final program should be established during which.

"The first year will be concerned with the production of sub-study" (first course, critical assessment). The preparation of a preliminary plan for the construction of an earth prototype will take place in the third year of studies.

The construction and test phase of the earth prototype will last 4.5 years so that the prototype will be ready 74 years after the start of the program.

"The construction of the reactor core assembly appears necessary during the exploratory period, possibly during the second or third year of the program. This assembly will use a fairly large quantity of fissile material, either plutonium or enriched uranium."

In a separate report, the Commissariat à l'Energie Atomique estimates that design of a ground prototype system can begin by early 1985. It estimates that work on an engine reactor will require approximately \$60 million by 1990.

Commission Studies

Overall, the commission's studies with space applications include:

- Design studies for a nuclear power source for satellites and of methods of energy conversion.
- Investigations and design of cosmic radiation detectors for satellites.
- Studies of the effects of radiation on various materials.
- "Dissemination" study of nuclear propulsion.
- Investigation of isotopic power sources and methods of converting the power.

The research and design of electrical propulsion systems. In this regard, CEA, French industry and universities have conducted joint studies on some propulsion techniques over the past several years, and the commission estimates that an operational system could be made available within the next 10 years.

The Office National d'Etudes et de Recherches Aéronautiques (ONERA) is a related effort in constructing a series of chambers for space propulsion simulation, with more than one-half of the work now in operation. Design and construction and use of these respective simulators are:

- STL—Tests of thermal plasmas,

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problems, and their resolution. 5. Continuing Government-contractor management consultation and agreement to maintain proper balance among reliability, cost, and schedule. 6. Specific and rapid performance errors. 7. High-level level of managerial approval for use of any parts requiring work to meet standards. 8. Detailed, brief, analysis of any part falling below Mercury standards. 9. Special technical liaison between Astronautics and its principal Mercury-Atlas suppliers. 10. Increased process of test equipment and procedures, and cross-load of test data, between suppliers, Astronautics' home plant, and the launch site. 11. Unsurpassed development control.

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satellite and spacecraft systems at simulated altitudes of between 10 and 100 mi. Volume is 1,100 cu ft, and the acceleration is operational.

• **A012**—Experiments with thermal plasmas and ionized gases at altitudes of between 50 and 130 mi. Volume is 175 cu ft, and the unit is operational.

• **B01**—Tests of ionized gases and particles at altitudes of between 100 and 300 mi. Volume is 125 cu ft, and the accelerator is operational.

• **A01**—Tests on optical and electrical signals at altitudes of between 200 and 600 mi. Volume of the unit, which is still in the design stage, will be 125 ft.

• **B03**—Experiments with models and other components, including wind tunnel tests, at altitudes of between 100 and 200 mi. Volume of the simulator when completed will be 1,050 cu ft.

CNES also plans to build a test facility at its Brétigny research headquarters near Paris that will contain a number of space research simulators including several tanks and one large vacuum chamber, a dynamic chamber for thermal cycling, a vibration machine and a centrifuge.

24-hr. Orbit

Beyond the presently planned six satellites which already have the stamp of government approval, CNES also is investigating the problems related to placing a satellite into a 24-hr. orbit along the principles of the National Aeronautics and Space Administration's Seven years. Studies indicate potential launchers, methods, rather than the ground is from a particularly low orbit, orbital transfer and correction, tracking and an advanced ground system that would be required, might be caused by growth, decreasing radio effects and economics.

Within the field of stationkeeping, CNES is following a number of options, including the first advanced one in this area with the launching of FR-6, but of the currently authorized area, which will be also studied. As further study, the agency also is considering earth-orbiting and stationkeeping satellites.

The first satellite with which France will attempt to break new scientific ground will be the FR-5, designed primarily to measure the hydrosphere distribution in the upper atmosphere with a payload developed by Prof. J. E. Brault, scientific director of CNES (AWW June 17, p. 20). A major first in most experiments will be carried through NASA's Joint satellite.

FR-5, which will include a laboratory for laser research, has a primary mission of studying the outgoing radiation in space, while the final period for FR-6 will not be determined until results of the earlier launches have been evaluated.

FR-2 and 3 will serve as essential flying laboratories for the French equipment, particularly the measuring of the satellite vehicle to the Diamant 1 launcher.

FR-1, which will be quickly followed by the launch of the 28-French FR-2 from Hammaguet, Algeria, will be placed into a 100 mi. orbit with the U.S. Pacific Missile Range in California. Prior to the orbital flight two FR-1 payloads will be fired from September at altitudes of between 125 and 175 mi. by Aerosol rockets from NASA's Wallops Island, Va., facilities in order to check out the over-all package. Payload is approximately 200 lb.

FR-1 Objectives

FR-1 is designed to study the very low frequencies (VLF) waves in the atmosphere and will carry a payload designed by L. R. O. Storer, chief of research at the Centre National de la Recherche Scientifique. Attempts will be made to measure the intensity, polarization and propagation direction of electromagnetic waves within the 10 to 100 kHz range. During the period of its orbit, the satellite will measure the VLF transmission from three major scientific communication stations.

French space officials also say that a study of the irregularities in the ionosphere distribution should help determine the local electronic density.

Overall responsibility for the FR-1 experiment has been assigned to the Centre National d'Etudes des Télécommunications, headed by Pierre Maréchal, chief of the center.

CNES has the responsibility for installing the payload into the satellite shell which is being built by Naso-Aviation.

Airide from the Nord contract, CNES then has been reluctant to enter the private firm engaged in the actual fabrication of the satellite shell and payload for the other projects already approved. Contracts, however, have been awarded for work on the FR-2 and 3 satellites and their payloads.

All five now scheduled to be launched by Diamant 1 from Hammaguet will be carried on weight and size by the capabilities of the launchers booster system.

The best payload performance, according to CNES, can be attained in an orbital launch at a latitude of 18 deg., which can place a 170-lb. satellite into an orbital plane with an apogee of 312 mi. and a perigee of 250 mi. A westerly launch, where the vehicle is moving against the earth's rotation, would cut the effective payload weight to 15 lb.

Food toward the east, Diamant 1 also could be used to place a 170-lb.

satellite into a circular orbit at an altitude of 312 mi., a 90-lb. payload into a plane with an apogee of 1,175 mi. and a perigee of 250 mi., a 77-lb. package into a 300-mi. circular orbit, or a 44-lb. unit into a path with an apogee of 6,240 mi. and a perigee of 250 mi.

Use of the nonpropelled Diamant 2 in the 1967-68 period will permit launchings of satellite vehicles weighing up to 550 lb. Normal period weight for the booster probably will be about 400 lb.

A need to retain the capability for firing satellites into an orbital orbit can have France to construct a second launch site on its own. One new under construction by the French army would be located on the South Atlantic coast and would permit launchings only to the northeast because of the populated area in all other directions.

The South Atlantic site is being considered as a military substitute for the Hammaguet center, which the army must vacate by July, 1967, under terms of the Evrya space agreement with Algeria. CNES President Camille Gaudin hopes that the Algerian government will continue to permit "peaceful" satellite launchings from Hammaguet. If not, a second site that would permit launchings to the east may be built along the Mediterranean in the region of Bordeaux.

Diamant 1 Weight

Diamant 1 will have a total launch weight of 36,600 lb. and an overall height of 55-ft. 6-in. These at the first stage Escapade, using a nitro and superoxide base propellant, will be 61,700 lb. as opposed to the 50,700 lb. planned for the first stage of the completely redesigned Diamant 2. Scheduled combustion time for the Escapade is 30 sec., and total thrust is 27,800 lb.

SEREX designed first stage of Diamant 2 will incorporate four rotating nozzles for directional control, whereas Escapade has only one such can and unit.

Solid propellant second stage for Diamant 1, designated Tigroue and built by Nord, has a total thrust of approximately 75,500 lb. with a normal burning time of 30 sec. Four externally guided gasbusting nozzles are provided for attitude control, and the area vehicle with some modifications and state-of-the-art improvements will be used for use on the Diamant 2 booster.

The Sophia third stage for Diamant 1, built to SEREX specifications by Sud Aviation, also incorporates a solid propellant and has a thrust of between 5,610 lb. and 11,900 lb. depending upon the mission requirements, plus a single fuel nozzle. Total propellant



What new data recorder can be simple—or sophisticated? AMPEX FR-1200

Here's the newest recorder from Amper—the FR-1200. It's a medium priced, basic data recorder that's modular in design and built for long-term reliable operation. With the FR-1200, you're offered various types of electronics and accessories, and with these you can tailor a recorder as simple or as sophisticated as you want—one that meets your needs and budget now, and can be expanded as you grow. You can start at the simplest level—a one speed, record only recorder—and build all the way to a 14-track, record/reproduce system with six



speed (15 in to 60 in) electronically switchable electronics and transport. Amper ES-100 solid state electronics offer Direct recording to 300 KC, FM recording to 20 KC, or 100 KC compatible PCM. The FR-1200 also features a new tape transport rugged and reliable, it offers low flutter, prevents tape stress during fast starts, provides constant tape tension on both reels and has new tape braking and guidance systems. For details write: Amper Corporation, Redwood City, California. Sales and service engineers throughout the world.

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Take the new Amphenol 225 series. This bellows-type connector has the smoothest, perfect, most efficient mating action you'll find anywhere. Even after thousands of insertions, the delicate conductive surfaces of the plated bowl are unscratched by the 225.

The 225-series has remarkably low contact resistance, too. For the solder terminated style, it's under 25 millivolts at 5 amperes.

The bellows-type contact on the 225-series is split down the middle. You get two contact points for every interconnection. That helps keep the contact resistance low, of course, but it also contributes readily to regular mating surfaces.

The 225 is covered in inserts and mates the printed circuit board with a mating action that causes contact.

AND, FURTHERMORE

The 225-series contact is self-anchored in the connector body. Con-

tact faces will not distort at the slightest pull on the terminals.

The 225-series has twice the flexing range that you'll find on other bellows-type contacts. This means you can rock the board twice as far with no danger of contact distortion.

The 225-series does not waste valuable contact space with a polarizing key. The key is sandwiched in between contacts.

The 225-series can be terminated with solder legs, laser pins, removable crimps, or Wire-Wrap® terminals.

Contact styles? Contact positions? Mounting geometries? Well, let's just say that there are over 100,000 combinations available in the Amphenol 225-series bellows-type connector.

WHO NEEDS IT?

And now for the facts of life. Some people simply don't need the 225-series. Some printed circuit boards are inserted once and never disturbed again. Some printed circuits are never subjected to pull on the terminations. Some printed circuits are not really so delicate that they must be protected from contact wear. Some printed circuit boards never get racked. And in some applications the space taken up by a conventional polarizing key is of no consequence. And so forth.

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line. That's the only man who can look you in the eye and tell you exactly which printed circuit connector you need. Objectivity.

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weight is 1,530 lb with a normal cruise thrust of 44-5 ac.

Second and third stages closely have been fired, and the first stage is scheduled to undergo a live launch test early next year.

Meanwhile, France for the past several years has become progressively involved in the development launch of a series of rocket probes. Initial development, as in the case of Diamant, often has been limited by the military, with the civilian space program being subject to the probe at relatively little cost.

As an example of the current pace in this area, a French government survey reports that 47 manned rocket probes were launched between May 3, 1952, and Feb. 28, 1963. These included 11 Véroniques built by Sud for the Laboratoire de Recherches Balistiques et Aerodynamiques, 7 Bérés, 12 Contours, 1 Diamant—also built by Sud—2 Météo-MED-1s and 4 Météo-Haut Emman, which have a maximum design altitude capability of 44 mi and can be produced at relatively low cost.

Under present planning by CNES and other French research institutions, similar launches will be continued on an accelerated basis over the next several years.

Standard Véronique, which has become a mainstay in French industry and will form the basis of France's second stage contribution to the initial multi-stage European Launcher Development Organization's three-stage booster system, can stand a 170-lb payload to a maximum altitude of 125 mi or 354 lb to 57 mi.

Advanced follow-on within the national program include the Super Véronique, which will lift 170-lb to a 212-mi altitude or 358 lb to 173 mi, and the Véronique rocket, scheduled to be made available to CNES by the year 2000. The latter, which can stand a 940-lb payload to an altitude of 216 mi or 2,200 lb to 125 mi.

All three units—Véronique, Super Véronique and Véronique—also liquid fuel propelled and use no guidance system aboard.

Sud-propelled Bérés, first launched in the spring of 1961, can carry a 70-lb payload to a maximum altitude of 73 mi. Contours, a Bérés plus a sustainer tandem booster, 66-lb in 132 mi, and Dugue, a two-stage Bérés with rocket boost, 198 lb in 250 mi. No guidance or control system is employed in any of the three.

Special research accompanying probes carried to altitudes of 21 mi and beyond by polyethylene balloons made between by Peter is also giving impetus with completion of a second launch center at Aéro-Sud-Air.

Two technology balloons, ranging in size from 1,000 to 2,000 cubic meters and capable of staying aloft for periods of 11 to



Centour-Surveyor Separation Simulated

Weightless conditions in space flight have been simulated at General Dynamics/Astronautics in a test of separation of modules of a Centour booster and a Surveyor unmanned spacecraft. Full-scale Surveyor mockup floats on nitrogen gas cushions to provide data on spacecraft separation velocities and tumbling rates and directions.

440 lb), were designed and developed primarily by Fiat-Bianchi and are fabricated by the continuous welding of polyethylene strips.

Balloon experiments already conducted in planned include studies of the solar corona, the molecular structure of the atmosphere and planets, space radiation and observations of the solar and lunar surfaces.

The French industry is moving deeper into space and spending substantial sums of its own in doing so. Individual firms realize that they must keep abreast of this new technology or inevitably fall behind in all aspects of their business. As a result, the industry is making studies for a series of new satellites for the CNES program.

When the FR-1 satellite program began, as an example, no French firm could follow the necessary solar cells required to supply power to the space systems with the precision and quality desired. Consequently, they were purchased directly from a U. S. outlet. Now, according to CNES, the French industry has the know-how and capability to produce on its own the solar cell units for later satellites.

FR-1 itself was all French except for the solar cells and the industry is beginning to take a lead in producing complete satellite packages. SPER, for instance, has completed a study on the Phoenix, which could be used for solar and power research, and SNECMA is pushing the Conquest, a 26-lb reconnaissance mini-telescope satellite. Further, has been set for launch in 1964.

In the satellite field, Air Liquide, Peugeot, Ugeux and Carbone Lorraine are working on cryogenic, advanced nozzle methods and propulsion techniques. Compagnie Générale de Véhicules

groupe tout Fil (CSF) and Thomson-Houston, among others, are becoming actively involved in the field of space electronics, both airborne and ground support systems, including navigation.

CNES still came into being in May 1, 1962, with an already established set of responsibilities laid down by its predecessor working group, including:

- Collection of all information on national and international space activities.
- Preparation of proposals for a national space program plan.
- Assurance that the adopted program is properly executed.
- The particular program includes design studies and final responsibility for the end product, as well as for the construction of CNES plants to construct directly with industry wherever possible.

- Overall coordination of the national space program, including France's participation in international projects.

Now, shortly more than a year after its formal incorporation, it is well on its way, and France obviously plans to continue and perpetuate its drive into space. CNES is increasing and encouraging the probing mind search efforts among the country's youngsters, offering scholarships to those who show the most promise and making it known that there will be projects that will hold their interest in order to dispel any temptation to migrate from France to the U. S. or elsewhere. In continuing upon the same path, and making the members of technically trained youngsters who will be available in France within the next future, CNES intends director Robert Armande has said. "It is up to us to ensure that, within the framework, in particular to the United States, the new blood flows into French laboratories, design offices and factories."

U.S., Soviets Plan Joint Space Projects

By Edward H. Kilham

Washington—Soviet analysis teams of people in the rapidly expanding U.S. international space program will be the first to participate in a launch and data exchange effort being planned by the U.S. and Soviet Union.

Terms of the bilateral agreement (AW Aug. 5, p. 37) provide for a time-table in which the two countries will establish a communications link by early next year, using the Echo 2 system as a passive relay point. Even before this link is established, joint conferences will be held to implement the key project as the orbit-coordinated weather satellite launches.

Planning also will begin for the third project—coordinated launch of multiple-man missions to map the geospace field.

Agreement with Russia will bring to rest the number of international co-operation satellite programs in which the National Aeronautics and Space Administration is participating, which involve five countries. In addition to the three USSR programs, they are:

- Canada—The S-27 Alouette atmosphere remote sensor, launched last September from Pointe Barre, Quebec.
- France—The FR-1 ionosphere-map atmosphere satellite to be launched in early 1965 from PMR by a Soviet vehicle.

- Belgium—Three separate satellites: the S-15 Aulpe probe, launched Aug. 30, 1962; the S-12 ionosphere satellite to be launched by Soviet from Wallops Island, Va., late this year; and S-13, an enlarged version of S-12, due to be launched from Wallops Island after completion of the other satellite tests are completed.

- Italy—Project San Marco atmospheric density satellite to be launched from a platform in the Indian Ocean near the coast with a Soviet in 1967. San Marco payload instrumentation is now being sent in a sounding rocket launch from Wallops Island. Some procedures will proceed the FR-1 satellite launch.

At its own study, the agreement with USSR calls for the satellite communications link to be established between U.S. and Russia as soon as possible after Echo 2 is launched. The launching is scheduled during the last quarter of this year from PMR, using a Thor Agena vehicle.

Coordinated meteorological satellite project will begin about the same time with the exchange of weather data obtained by satellites. The schedule calls for coordinated satellite launches starting late next year.

Arnold Friedman, director of NASA



SAN MARCO PAYLOAD is prepared for a sounding rocket test from Wallops Island, Va., by U.S. and Italian technicians. The payload is shown both with the firing removed and in place. See story, which is scheduled to be launched from a platform in the Indian Ocean near the coast with a Soviet in 1967. The payload is a sounding rocket, which the U.S. is launching. The sounding rocket, called Shogun, consists of a Thorad P-1000, 100 ft long, with two Thorad boosters and solid. At launch, the combination weighs 130,000 lb. The second stage is an X-100, manufactured by Hercules Powder Co., Albuquerque, New Mexico. The vehicle has a launch weight of 13,000 lb., and is 32 ft long with a Thor ad.



international program, pointed out that the U.S. took in the agreement will be sent by the Nimbus polar orbiting satellite, and the Soviets also will launch polar weather satellites. Parts of the two vehicles will be placed so that they are 90 deg apart, so that out of the two satellites will cover each spot on the earth every six hours.

The geospace field program calls for each country to launch a satellite equipped with spectroscopics in 1965. One of the uncoordinated space program by payloads, Friedman said, is in preparation to bring dollars into the country and thereby help offset the unfavorable gold flow. He estimated that since the astronomical program started, about \$45 million in foreign money has come to the country at payment for payloads and instrumentation.

Friedman feels the foreign market could be expanded significantly through the sale of the Douglas Delta launch vehicle. The European Launch Development Organization (ELDO) is developing a relatively heavy launch vehicle based on the Atlas 5000, which is being launched by the Atlas 5000. The European Launch vehicle (AW June 18, p. 20).

This, Friedman said, leaves a big hole in the northern launch vehicle chain that could be filled by Delta, which is the most successful of all satellite U.S. vehicles. The Soviet communications payload launched July 26 (see p. 77) was the 70th successive successful Delta mission.

European Space Research Organization (ESRO) already has made what Friedman called "an obvious" re-

gulating purchase of Delta for launch both from and elsewhere. Western Australia range will be used for the Atlas 5000 launch, and Delta could be launched from that complex.

At the U.S. international space program has matured, Friedman said, it has become clear that in Europe the space program is being pushed in the face of its economic and technical potential. The Europeans, he said, "believe space technology represents the freedom of the air."

At this time, in addition to the five countries with which U.S. has bilateral agreements for co-operation, satellite projects, there are agreements with France and Britain to launch three separate U.S. satellites, agreements with 12 countries for joint sounding rocket programs, with 40 countries for weather satellite observations, with 18 countries for communications satellite observations, with 15 countries for ionosphere satellite observations, and with 14 countries for ionosphere sounding satellite observations.

U.S. also has established 14 separate agreements for foreign tracking and data acquisition stations. Some of the Moscow net, Soviet ionosphere sounding rocket, two the deep space net, space optical stations, 25 ocean-weather stations and four data acquisition stations.

Personnel Exchange

The international program also has grown in terms of personnel exchange. At present, there are 44 foreign in the U.S. and 13 in the U.S. in the Soviet Union. The Soviet Union is sending a research at NASA center. Another 21 students from that country are at the U.S. for research under NASA sponsorship, and 108 foreign nationals from 35 countries are undergoing technical training at NASA centers.

The foreign instrumentation as NASA satellites include a photometer to be built by the University of First, which will be carried on the polar orbiting geophysical character (Fig. 1), an ionosphere spectrometer built by University College, London, for the ionosphere remote sensor, which is being developed by University College, London, and the University of Leicester, to be flown on the third sounding meteorological observation, and three solar wind measurement device built by University College and University of Leicester, on the fourth orbiting solar observatory.

Sounding rocket projects are the subject of the international space flight program, and probably will continue to be the majority of the overall international program because the rockets are relatively inexpensive and can deliver a wide variety of instruments from a number of specialized launch sites. PM Chavil, Canada, has re-

quire, in an excellent site from which to launch the sounder nose. Between 1955 and 1961, 36 U.S. rockets were launched from the site, and the plan is to launch 10 a year from there.

The sounding rocket agreement with Canada also included launch of an Canadian Black Brant rocket from Wallops Island last year, because of fire damage that took it. Chavil cut off operations 22 last year.

Rocket Agreements

Sounding rocket agreements also are in effect with these countries:

- Agreement to launch an unspecified number of Nike Capitan launchers, Argentina, next year to measure electron densities in the D and E regions.
- Australia—Launch of four Sirok rocket from the Woomera range to measure ionosphere variations, due in late 1965, and launch of two Auroras 196A rockets from Wallops last April and May to measure VLF radio noise in the ionosphere.

- France—Launch of optical experiment on Nike Capitan from Wallops in 1961, and the launch of an Auroras 190 next September to study ionospheric structure in the D and E regions.
- The FR-4 ionosphere satellite will be tested at Wallops Island in Shogun launch.
- India—Launch of an unspecified number of Nike Capitan and Nike Apaches from the Thiruvananthapuram range late this year.

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FIRST SATELLITE DESIGNED and built by the British, UK3, is shown in model form, 5 ft. high and with a 74-ft. span across the boom.

UK3 Satellite to Carry Five Experiments

By Robert J. Coleman

London—British Aircraft Corp. has begun cutting metal for the first all-British research satellite, the UK3, after long years of discussion between the Royal Society, British government and the Royal Aircraft Establishment succeeded in financing a five-experiment payload package.

The UK3 will be launched in about three years from Wallops Island, Va., with a four-stage Scout booster (JAN Nov. 17, p. 50). Mass structure is being built by IAC Structures in collaboration with Newbury Works and Telegraph Co. (JAN July 32, p. 33).

First details on the UK3 payload package were outlined recently by Dr. Harrie Massey, professor of physics at University College of London and chairman of the British National Committee on Space Research. Major details disclosed include:

- Meteorological office experiment, headed by Dr. R. Durr, to measure the vertical distribution of oxygen in earth's atmosphere at levels where molecules begin to be destroyed by solar ultra violet. Measurements will be made of the intensity of direct solar ultraviolet radi-

tion as seen through the oxygen absorp-
tion region of the upper atmosphere at
times when the UK3 is entering or
leaving the earth's shadow.

- Modified Radio Astronomy Observer
box, Cambridge, measurement of the

existence of radio noise from sources in
the galaxy at frequencies too low to be
observed from the ground, with self-
count angular resolution power in dis-
tinctly compensates from the galaxy
plane and the galactic hole against

British Payloads for U. S. Satellites

London—Under a plan formulated by National Aeronautics and Space Administra-
tion, British scientists now are allowed to compete on equal terms with their U.S.
counterparts for payload space on U.S. satellite satellites.

- Proposed payload to be in the large laboratory family of satellites include:
• Study of solar helioseismology experiment, an experiment by Prof. B. L. P. Boyd
and Dr. A. F. Williams, of University College of London, for inclusion in OSO-4
(through NASA Orbital Solar Observatory, scheduled for launch in 1969).
• Distribution of small solar X-ray collector, a backup mission for OSO-4 in
collaboration with Prof. B. A. Stewart of the University of Leicester.
• Study of auroral sources of solar X-ray emission, selected for definite inclusion
in OSO-4, to examine features of X-ray from particular phase in the sun and
using various instruments.
• Study of X-ray emission from stars, an experiment developed by Prof. Boyd,
Prof. Stewart and Dr. Williams and selected as a payload experiment for
OSO-3 (through NASA Orbital Solar Observatory, scheduled for launch in
1968).

NASA also has asked Prof. Boyd and Dr. Williams to provide, for installation
on the S-B Tagula spacecraft launching satellite, the mass spectrometer probe
designed by them and owned in U.K. the Royal Society. The probe measures
mass and temperature of atomic and molecular ions throughout the satellite's orbit.



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• **University of Sheffield**, in an experiment headed by Dr. T. R. Kneen, will measure very low frequency (VLF) radiation, its spectral and temporal variation and its spectrum. VLF noise intensity will be monitored at three fixed frequencies at a number of points around each orbit. Frequencies are 12, 9.6 and 16 kc, harmonically related to facilitate calibration in flight. Wide-band (about 1 kc) and narrow band-width (100 cps) will be centered on radio station GBH at Rugby to study field patterns.

• **University of Birmingham** experiment devised by a team led by Prof. J. Soyer, will survey the atmosphere above the F₂ maximum by measuring the electron density and temperature at frequent points along path of the satellite. The measurements will be made by a plasma probe developed by the Birmingham group for the British Space satellite but refined to take a higher frequency of 40 mc and modified to enable measurement of electron temperature.

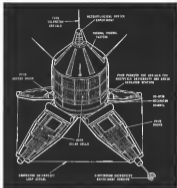
• **Radio Research Station** near headed by J. A. Fitch, plans to determine the flux of radio wave energy at the altitude of the satellite, at selected radio frequencies, from natural terrestrial sources (mostly thunderstorms) and the geographical distribution of the sources at different times of the day and different seasons. Radiofile and data will be used in the design of highly directional search and will help show to what extent radio noise is a potential source of interference to satellite radio reception.

British Aircraft Corp. will build five UK1 satellite-the actual prototype, two fully equipped prototypes for testing the flight model and a backup spare. The company now is building up to a 35-man engineering team at BAC's Guided Weapons Div. at Stevenage. Instruments will be provided by the company's Bristol works, which already has gained considerable experience in instrumenting the United States-built UK1 (Acid) and UK1 satellites.

UK1 will enter a circular orbit. Precise calculations based on the expected atmospheric density at the planned time of launch in 1966 indicate that a 400-mi altitude will be satisfactory to carry out the five experiments.

Closed angle of inclination will be 57 deg., which meets the requirements of the Radio Research Station experiment and the Meteorological Office program.

The orbit will be attained by drag in a southeasterly direction from Wallops Island. After burnout of the third stage, the Scout nose cone will be jettisoned, leaving the satellite to coast atop the fourth-stage motor. The motor will then be ignited and spun



DRAWING OF UK1 (above) shows positioning of major systems and five experiments devised by British scientists. Continuous cross-sectioning (below) holds equipment and experiments. Some satellite radio waves (lower) show attachment points are orbits mounted in glass fiber. Total satellite weighs a 150 lb.



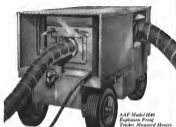
by tangential nozzles to maintain directional stability.

BAC and the shape of the satellite represents a compromise between the conflicting requirements of power supplies, thermal control, aerodynamics, the five experiments, structural strength and so-

on. Overall diameter, length and base lengths were dictated by the Scout rocket.

Scout design was determined by the thermosphere experiment, which demanded that much payload be mounted beyond a minimum distance from the

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Developed by the engineers who control Washington's environmental control system, R40A contract for Wing 11, Amesbury, AAF and its subsidiaries are now completing installation on Wing 11, Edwards AFB, D. C.

satellite body, with no solid material located outside a cone generated at the center of the boom. The motion mechanism consists of four loops connected by a central pin so that all four booms swing simultaneously and symmetrically to permit motion of the satellite.

Originally, all solar cells were mounted on the satellite body, but subsequent experiment requirements necessitated mounting some from the body and reflecting them to the booms. By stretching cables between the booms tips, four long arms could be provided for the Cambridge experiment.

Solar Cells

About 6,000 solar cells will be built onto the satellite. Layout on body and booms gives a maximum change in projected area as the satellite rotates and tilts in relation to the sun line.

Trays holding the cell are designed so that additional cells can be added at a later date without structural redesign, in the event the power requirements increase. Five experiments and a maximum of 5 m, but the solar cell provide 18 m.

Upper rim and the bottom face of UG3 have been left uncovered to provide a sufficient sun-collecting area for the Birmingham experiment.

Basic structure of UG3 has been simplified so that the body consists of a central torque tube off which four honeycomb vanes are mounted in a cross-like layout. The tips of the vanes carry a flat disk, radiating from the center of the structure, and the bottom ends are closed by a flat diaphragm. Vane perimeters necessary mounting area for equipment and instruments, the outer edge of the bottom diaphragm carries a torque arm, which secures the torque mechanism, and the outer surface carries the four transducers for measuring the boom.

Parite Red Aerols

UG3 includes four ferric red aerols—three for the Radio Research Station experiment and one for Sheffield University—which are mounted across the booms near the attachment to the body. Each is contained in a foam-filled glass fiber cylinder bolted to the booms.

Each aerolous consists of a pair of weights, attached to metal ribbons, which are wound around the base of the satellite and locked by explosive bolts. Do a time consumed, after four-hour-long exposures, the bolts are fired and release the weights, which are thrown out centrifugally. Two aerols, consisting of oil-filled tubes containing sliding weights, are fitted to the satellite to damp rotation and to maintain a near balance about the spin axis.

Statistics are of the total weight

cadmium type, using two 1 amp/hr cells per battery. One battery is on standby while the other is in use. The control system connects one battery to the power distribution system while switching a trouble change to the other. A solid-state counter pins one battery on full change for eight orbits, a total of about 12 hr., and then the other battery for the next eight orbits. At the end of the period, the first battery is put back on line.

Teletype recorder is mounted at the bottom of the central torque tube on the satellite. The package includes a record and playback amplifier, playback

tapes, speed controller and a photo-shut mechanism to provide a three-page supply to the camera motor.

Two programmers are provided. No. 1 gives orders to the recorder and telemetry transmitter, putting an information tone on the transmitter at the verge of a command and a time marker on the tape. No. 2 provides two operation modes for the onboard computer at various times and mode 2 accepts only the Meteorological Office experiment output and mode 1 switches to all other experiments except the Meteorological Office 8 min after sun set.

PRODUCTION BRIEFING

Roll Aerospace Co., Buffalo, N. Y. has received an \$11.2 million contract from Grumman Aircraft Engineering Corp. to develop and construct the Launch Extension Module (LEM) of Project Apollo (AFV Doc 10, p. 35, July 22, p. 14).

Development Corp., Washington, D. C. has a \$900,000 contract extension from Air Force for continued maintenance of aircraft and aircraft base facilities for the USAF Space Systems Div. at Los Angeles International Airport. Work will continue through June 30, 1964.

Bentz Aircraft Corp., Wichita, Kan., has a \$2.4 million, fixed contract for additional target missile work. Contract provides for production of Model 1025 Cavalier target missiles, \$602,000 for flight support at Ft. Huachuca, Ariz., and \$1,800,000 worth of target system spares.

Aero Corp. Aerospace Structures Div., Nashville, Tenn., has secured a \$7 million follow-on contract from Lockheed-Georgia Co. for completed production of C-119 components.

Kyle Aeronautical Co., San Diego, Calif., has received a \$2.5 million Army contract for follow-on flight testing of the Ryan-Verne XV-5A V-STOL research aircraft. Additional funding provides for Army pilots to phase into the XV-5A flight test program scheduled for early 1964 at Edwards AFB after company test pilots have completed initial flight research.

Emco Electronics Div. of Ling-Temco-Vought, Inc. will continue to develop and produce fluid injection valves for the Time 1 solid propellant test engine under contract of a new \$2 million contract with United Technologies Corp., Scarsdale, Calif.

Term Instruments, Inc., Dallas, Tex., will lease an 18,000 sq. ft. manufacturing facility near airport construction at Fort Worth, Texas, near Fort Worth, Texas. The facility will be used to manufacture thermoelectric and electronic modules. Plant is expected to be in operation before the end of the year.

Kanawha Aircraft Corp., Blountfield, Conn., has a \$433,352 subcontract from Grumman Aircraft Engineering Corp. to manufacture emergency ejection seat cushions for the F-105. The cushions include three model seats, stabilizers and ejection. Deliveries will start in January.

Kellett Aircraft Corp., Wilkes-Barre, Pa., has created a new products department for producing the firm's existing proprietary products, and for developing new ones as well as unique methods of materials handling.

International Aircraft Services, Inc., Oakland, Calif., has a \$2.7 million Air Force contract for maintenance and modification of F-105 aircraft. Work will be done in Oakland.

FMC Corp., New York City, has a \$4 million Air Force contract for production of one-eighth scale liquid hydrazine (UDMH) Work will be done in Baltimore, Md.

Pratt & Whitney Div., United Aircraft Corp., East Hartford, Conn., has received a \$5 million Bureau of Naval Weapons contract for continued general development and testing of the TF38 engine for the F-111 (TF38 contract was totaled \$12.7 million).

General Dynamics/Fordham, Pomona, Calif., has been awarded a \$15 million contract for continued research and development work on the Modulo missile system.

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SAC U-2s Modified for Fallout Sampling

By G. M. Plattner

Yoncos, Air-Strategic Air Command's Lockheed WU-2 wing at Davis-Monthan AFB here is being modified up to 53 ft in length at altitudes as high as 70,000 ft to gather high-altitude nuclear fallout samples. Typical missions cover a distance of about 3,000 miles.

Weather designation, W, was recently added to the specially-equipped U-2 aircraft of the 480th Strategic Wing, "The Crossbones," now detached from the title of the wing as far as the Defense Dept. Now designation emphasizes the air sampling mission of the wing, which moved here recently from Laughlin AFB, Tex.

WU-2s equipped for upper air sampling have special nose and side intakes. The nose intake is used to collect gross samples in three canisters located in the forward nose section. On the lower left-hand side of the aircraft, an air particle intake brings air samples to a filtering system which extracts aerosol particles for analysis of particle density in the sampling area.

An engine-driven blower provides the sampling equipment with power at a power at frequencies varying from 570 to 495 cps, depending on engine speed.

Other Air Force U-2s of the Strategic Command are based at Edwards AFB (AW Sept 25, 1962, p. 243) and used in various weather reconnaissance missions, including photographing cloud patterns. However, since they are not

equipped to upper air sampling, the Ed-ward aircraft are still designated U-2s.

In support of its high-altitude sampling mission, the 480th wing assigns small units, called operating locations (OLs) to foreign and other U.S. bases. Current units assigned to an OL are rotated approximately every three months. When flights over other countries are necessary, permission from that country is required.

Overflight Approvals

Currently, Canada, Argentina, Puerto Rico and Australia have granted overflight privileges in support of the air-sampling program. These countries also support the mission with noise and ground communication coordination. OLs are now located at Italian AFB, Alaska, Alaska AFB, Panama Canal Zone, Royal Australian Air Force Station, Lavarca, Australia, and Birdsville AFB, La. (C).

Other fields from which WU-2s have flown in the past, include Azores International Airport, Buenos Aires, Argentina, Patafina, Brazil, N. Y., Ramoey AFB, Puerto Rico, Naval Air Force Station, Upper Hailford, United Kingdom, Royal Air Force Station, East Solon, Australia, Andersen AFB, Guam, Kadena AFB, Okinawa, Hickam AFB, Hawaii, Howard AFB, Panama Canal Zone, Laughlin AFB, Tex., and Minot AFB, N. D.

Technical discussion for the High Altitude Sampling Program (HASP) is provided by the Defense Atomic Support Agency (DASA). HASP WU-2s

now fly at constant altitudes between 50,000 and 70,000 ft at 5,000-ft intervals.

The Defense Atomic Support Agency would like to add high-altitude sampling flights to its HASP program to gain more information about the nuclear debris in the upper atmosphere, but this would require different aircraft. A gain in information about long-range fallout of between 5 and 15% could be realized by flying missions at 75,000 ft levels, according to DASA spokesmen.

Altitudes up to 90,000 ft have been reported for U-2s powered by J-79-P-13 engines (AW Mar 23, 1960, p. 32). WU-2s of the 480th are powered by Pratt & Whitney J-75-P-11A turbojet engines rated at 11,200 lb of thrust at sea level.

On sampling flights, pilots wear dosimeters to guard against over-exposure to radiation. Only two pilots have been awarded insignificance for two months in the HASP program.

The pilots ordinarily spend between nine and 10 hr in their partial pressure suits, including three spent pre-breathing oxygen. Three partial pressure suits, when pressurized in an emergency, will maintain an equivalent altitude of about 20,000 ft. Before flights during which they are dosed in the event of depressurization, pilots pre-breathe oxygen for 30 min. When fuel conservation requires that they maintain altitude in the event of depressurization, such as during flights over water, pilots pre-breathe oxygen 1 hr

The pre-breathing procedure removes nitrogen from the body and prevents bends in the event cockpit pressurization is lost suddenly.

About the WU-2, a stretched 1,740-pm engine system is used. The three-saddle system of 500 or so saddle provides sufficient oxygen for over 8 hr.

All mission checklists and tasks are pre-computed on the ground prior to flight by a special navigation section. About 15 navigation are included in this section. Missions must be pre-planned because the cockpit of the WU-2 is too small to permit the use of tables and charts required for celestial navigation, although a star-plot-controlled section is housed in a small glass bubble protruding from the upper nose section port forward of the cockpit.

Sextant Fixes

Fixes using this section are taken only to check pre-planned checkpoints requiring close adherence to planned routes. When using the sextant, the pilot observes the visible image on a screen in front of him and cranks the celestial look inside a projected illuminated bubble to pinpoint the fix. The sextant. Reflected light and elevation of the instrument is accurately placed by means of manually-operated controls connected to the sextant through flexible cables.

Modifications have been kept to a minimum in the WU-2 and have only been implemented as the navigation and communications mission. No changes have been made to the basic aircraft since the Air Force accepted the first three U-2s in mid-1955.

Avionics Equipment

Avionics equipment includes small, lightweight VOR and ADF units, with voice communication provided by multi-channel ALC 14 UHF and Collins 618T. High frequency radio is installed in an antenna housing on the top of the antenna housing, added when the aircraft was manufactured.

A maximum of extra equipment is installed in the WU-2 and basic systems have been kept simple, using no standard, self-power-on components.

Low-volatility fuel, MIL-F-21424A, is used in the WU-2 to prevent fires due to evaporation at high operational altitudes (AW May 23, 1956, p. 15). IP-4 can be burned in the WU-2's, but had to be built up carbon deposits on the fuel injection nozzles, which choked engine life due to an irregular burning pattern. Use of IP-4, which also has a thrust density, results in about a 2% thrust margin.

Take-off and landing speeds of the WU-2 vary between 90 and 100 kt, depending on fuel load and runway temperature. Initial rate of climb is about 6,000 fpm with a climb angle of



WU-2s REMOTE SEXTANT (shown) is located in front of cockpit. Pilot uses the sextant to check pre-planned navigation points. Remote indicator in the cockpit allows pilot to check sextant directly with remote local controls. WU-2 (below) is shown filled with nose and side intakes for upper air sampling. Nose intake is used to collect gaseous samples in three canisters located in forward nose section. Filtering system extracts aerosol particles from the air and filters are analyzed for radioactive particle density in the sampling area.



about 45 deg. Although fuel power is mostly used for takeoff and climb, maximum EGT of slightly over 600°C reaches only to 96 in 97% for takeoff on a hot day. Landings may be made with a crosswind component of up to 15 kt at 90 deg.

Other components and key sections of the WU-2 configuration include:

• Wet wing fuel system. All fuel (1,335 gal maximum) is stored in the wings, which require support on the ground when fully fueled. Recovery swiveler gear, called Popo, support



How much will one USAF StarLifter lift?

Twelve M151 1/4-ton utility trucks, three 106mm recoilless rifles, three 1/4-ton trailers, one mechanical axle with rocket launcher. Total payload: 48,761 pounds. Distance transportable: 4,500 nautical miles.

This is a typical example of how the new C-141 StarLifter will give MATS the airlift power to increase the Army's air mobility.

The StarLifter will also transport 154 troops, 127 paratroops. And it can carry many combinations of men and machines, including outside vehicles that never could be airlifted by jet before.

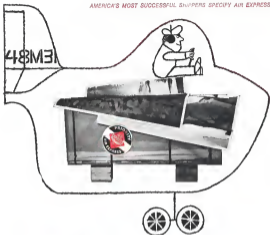
The C-141's truck-bed height or drive-on ramp rear-loading design permits immediate access to the 7,000 cubic foot clear cube cargo area. For palletized cargo, the C-141 will use the new 463L mechanical loading system. In a matter of minutes, the big turbofan airlifter can be loaded and be on its way.

Progress report: The first C-141 StarLifter is scheduled to fly this December, starting military and commercial certification testing.

Lockheed C-141 StarLifter

LOCKHEED-GEORGIA COMPANY, Marietta, Georgia—a division of Lockheed Aircraft Corporation





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— J. A. Winkler, *Tráfico Ilícito de Oculos: Un negocio de guerra*, *El Comercio*

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U.S. Business & Utility Plane Shipments

May 1994

[illegible]

Note. This bridge toll for January through May is 1.07¢ (about half the toll) on tolling rates of \$25.00, \$50.00, and \$75.00 for some period last year by nearly 50¢ (about one penny) in toll bridge. After the tolling rates, tolling rates of tolling rates are \$25.00, \$50.00, and \$75.00. Tolling rates are \$25.00, \$50.00, and \$75.00.

Hollmann, Wm. & Hagerd: 2 E. Parkside
diversity collected Nov. 2, 1945, 100
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Hollmann, diversity, 771 stages of common
stock; G. E. Taylor diversity, 144 stages of
common stock; W. & Hollmann, 240
stages of common stock; All stock from
Hollmann collected Nov. 2, 1945.

The Sealed Corp.—N. F. Peterson president and director; \$178,000 salary; 1,000 shares of stock; A. F. Hamilton chairman; vice president and director; \$69,000 salary; 1,000 shares of stock; H. K. Peters vice president and director; \$42,500 salary; 1,000 shares of stock; W. B. Dougherty vice president secretary and director; \$61,250 salary; 1,000 shares of stock; E.

London (AP)—President and director, IBM, T. J. Watson, says IBM shops at stock, U. S. News & World reports, and director John H. Olin says many sources of work on the same date Mr. Olin had a conversation in letters to IBM classes of stock of the corporation with a plan to receive such action upon termination of certain trusts on an agreement to the U. S. (AP). U. S. and

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observed 100 clumps of stock. C. K. Knecht

divided 1,149 shares of stock. H. J. Lovelock owned 500 shares of stock; C. H. McQuinn owned 300 shares; and the other 349 shares were owned by 124 other individuals. The Charles Stewart Mott Foundation was the largest holder of 25.5% shares of stock of the corporation and members of the Mott family group owned 31.6% interest. R. B. Feltner, director, 417 shares

ST 4000. All stock eventually owned as of Aug. 1, 1999.

* The Boeing Co.—W. M. Allen, president, and director, paid his salary 1946 amounting to \$10,000. He also received \$10,000 for his services as director for the year 1947 or was named under the incentive compensation plan for the year 1948. He is the Allen in June of 1947 of 41 1/2% in stock and \$110 in capital stock of the company, which amounts were credited to a deferred compensation system.

[illegible][illegible]

shores of which for each 1100 m² contained 4000 and 1000 *Hydrochara* respectively in a 100-cm² area of 100 m² above, subjected to sedimentation in 1000 m² of the same area in the laboratory. A. L. Smith, Director, 948 shore of Lake, E. P. Blackwell, 1000 predicted abundance, and made various observations after May 24, 1917, and Director, 1000 of 12, 1922, no more than 1000

1987 Federal Income Tax is set forth in Mr. Strickland's upon the information from other employees with the company pursuant to terms of an employment agreement entered into as of May 18, 1983). 100 shares of stock. W. C. Ford donated 1,000 shares of

70



**BETWEEN
MISSIONS, THE
NORTHROP F-5
CAN BE
SERVICED AND
REARMED
IN ONLY 7½
MINUTES**

After returning from an intercept mission, the F-5 can be serviced and rearmed, ready for another mission, in an amazingly short time. Just 7½ minutes.

The reason for this fast turnaround time is that the F-5 is extremely easy to service. Approximately one-fourth of the fuselage area is composed of doors and

panels which permit rapid access to all internal components. All systems are easily accessible from ground level without special workstands or ladders. Refueling can be accomplished quickly at a single point.

The F-5 is a highly practical supersonic fighter in many ways. It can operate from the sod fields and im-

proved runways of forward-area bases. It consumes half the fuel of other contemporary supersonic fighters. In operational squadrons, the F-5 will require considerably less man-hours of maintenance per flight hour than other supersonic fighters.

With all this practicality, the F-5 also delivers high

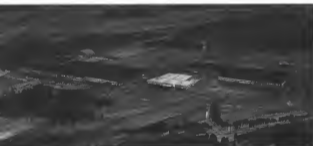
performance. In ferry configuration, it has a range of 1,650 nautical miles. It can carry 6,200 pounds of ordnance payloads and extra fuel. It can perform air superiority, reconnaissance, attack, or close support missions. It can climb 50,000 feet per minute from sea level, and fly supersonic to altitudes above 50,000 feet.



NORTHROP F-5



Defense Center



Defense Center

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Assembly of XB-70 Prototype Completed

Dayton, Ohio—Last range problems in assembly of the first of three USAF-North American XB-70 prototypes—making of a fuel tank before welding the wings to the fuselage—has been completed, according to Armstrong Services Div. at Wright-Patterson AFB here.

First flight test is still scheduled for the end of this summer, even though final wing tank sealing was about two weeks late. Brig. Gen. Fred J. Axtell, USAF B-70 project chief, qualified this, however, in saying that first flight test could occur as late as the end of the year, even though no other major problems remain.

Remaining to be accomplished is welding of the wings to the fuselage, followed by sealing and pressure checking of these body fuel tanks. The wing tanks will be scheduled after welding. Wing alignment to within 2 in. of the rails and installation of skin ties, now in progress, provide sealing of the wings to the fuselage. Alignment tolerances are ± 0.002 in. The welding schedule in 34 days and consists of four subtasks: 52-ft. welds. Struts of wing welds and extension of clippage in the assembly schedule will be made Aug. 30, according to Wright-Patterson officials.

Hydraulic lines have been tested to 6,000 psi, which is 3,000 psi over design requirements, with a pressure used to check wing installation. All components are already in place in the aircraft, vapors are installed and the cockpit

is completely finished and tested.

First flight will include ferrying the XB-70 from North American's Palmdale plant to Edwards AFB, where the flight test program is to be conducted. First flight probably will not be supersonic, although this is still being considered.

No further techniques in hardware need to be developed at the test, in contrast to last fall when delays of the last flight dates began due to sealant problems. At that time, the basic problem of low-quality honeycomb was compounded by hardware's damage caused by workers inexperienced in its handling. The difficult problem that then needed was using the repaired portions of the 0.005-in. to 0.011-in. honeycomb face uniform.

The repair technique was to cut a plug to replace the section enclosing the damaged area and spot-brazed the plug into place.

In some regions, a flat piece of metal, called a shoulder, was laid over the plug and spot-brazed to the skin.

Initially, metal-to-metal sealing of the plugs resulted in excessive leakage rates from the fuel tanks. Leakage rates were diminished by filling the flat fuel tanks with helium and using a helium leak detector—a mass spectrometer—to determine leakage patterns. Manual operation of the XB-70 calls for tanks filled with JP-4 and pressurized with nitrogen. Both JP-4 and nitrogen have much lower leakage rates than the sealant because stress used in ground testing.

North American was unsuccessful at first in using metal-to-metal seals, so together with Wright-Patterson's Field Cantal Laboratory, it developed a high-temperature, chlorine solvent called Viton B which they applied to the brazed plug areas to seal them. They are now returning to metal-to-metal seals as a result of improved capability in sealing techniques refined during this phase of the B-70 program.

Along with handling techniques, the quality of the honeycomb has aspects of its extent that its use is no longer considered a problem.

The second XB-70 is now 60% completed with most of the forward fuselage assembled. It has a January, 1964 flight date. Final work on the third prototype is under way. It is about 30 to 40% completed and will be slightly different from the first two models. The third prototype will be equipped with an integrated bombing and navigation system which made necessary a bigger cooling system to accommodate the additional environmental control requirements of the bombing/navigation system and a bomb bay door. It is scheduled for a December-January, 1964-65 flight date.

The B-70 program will terminate in January, 1966, unless it is extended. By that date, all necessary test data and flight time will have been gained, according to the present schedule. The total overall allowance for the program is \$1.3 billion.

Miss probabilities of the aircraft is



CH-46A Sea Knight Completes Blade-Folding Tests

Using Visual-Motion Coqs CH-46A Sea Knight helicopter has completed powered blade-folding tests at Vought's Flight Center, Philadelphia International Airport, prior to delivery to the Navy. Blade-folding is designed to facilitate storage aboard carriers. Auxiliary power plant is used in folding and unfolding for electrical and hydraulic power. Blades have a 21-ft. radius.

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GENERAL ELECTRIC



M39 Cannon Installed on F-5A Mockup

One of two M39 20-mm, ramjet-powered cannons is shown being installed in full-scale mockup of the nose of a Northrop F-5A jet fighter bomber. M39s, built by Springfield Armory and General Motors' Pontiac Motor Division for a rate of 1,800 rounds/min. Cannon will be fired as F-5A beginning with fifth production plane.

expected to prevent no real problems should the program be continued.

The Seams and House incorporated \$363.7 million more than the Kennedy Administration requested for the RS70 program last February (AW May 4, p. 24). The \$363.7 million would be part of \$1,070,000,000 needed to build two additional prototypes beyond the three already being assembled. The RS70 costs primarily as a reconnaissance design concept and has not progressed any farther, due to the intense economy.

failed to the program since its inception. The M39 designation refers to the first three prototypes.

Production emphasis would be on quality control rather than on high skilled labor which is not required for assembly operations. Back in November 1963, the M39s had not yet been assembled, which was partly of welding problems. Most manufacturers expect that might be recovered would be made using the play-around without any degradation of the aircraft's structure.

FINANCIAL BRIEFS

Cobra Electronics, Inc., had first six months of 1963 sales of \$4 million with a net income of \$192,150 or 14 cents per share. Some period last year showed sales of \$3.3 million and a net profit of \$118,352, or 1 cent per share. Booked stock at \$2.5 million on June 30 compared with \$1.7 million in 1962.

Pacific Aerospace Corp., and aircraft sales last sales totaling \$13.7 million with a loss of \$126,000 equal to 14 cents a share for the six-month period ended May 31. Comparable figures for last year showed sales of \$13.8 million with a profit of \$190,000, equal to 25.5 cents per share.

Perini Corp., Inc., report first half 1963 earnings of \$309,895, or 20 cents per share, on sales of \$5.6 million.

Emergency first a respectable period last year were \$75,114 or 14 cents per share on sales of \$5.5 million. The first attributes that increases to compare sales and net control products.

Treat Instruments, Inc., Dallas, report sales of \$65.5 million with earnings of \$2.8 million—73 cents per share—for the second quarter ended June 30. Comparable period last year showed sales of \$62.7 million and earnings of \$2.4 million—99 cents per share.

Electronic Communications, Inc., St. Petersburg, Fla., had a net income of \$23,663, 91 cents per share, on sales of \$27.7 million for the nine-month period ended June 30. Some period last year showed \$493,261—62 cents per share—on sales of \$25.9 million.

Republic Aviation Corp., reports consolidated sales of \$178.6 million with earnings of \$3 million, equal to \$1.08 a share, for the first six months of 1963. First six months of 1962 showed sales of \$174.6 million with earnings of \$2.7 million, equal to 91 cents per share. June 30 backlog was \$441 million.

North American Aviation, Inc., had a net income of \$27.9 million—\$3.31 per share—on sales of \$8.2 billion for the nine-month period ended June 30. Comparable period last year showed North American with a net income of \$28.5 million—\$2.94 per share—on sales of \$1.1 billion. Backlog on June 30 totaled slightly over \$1 billion compared with \$1.4 billion on June 30, 1962.

Motors, Inc., had sales of \$172.2 million and profits of nearly \$5 million—equal to \$1.22 a share—for the first six months of 1963. Sales last year were \$179.6 million with earnings of \$5.7 million, equal to \$1.41 per share.

Balfour-Lux-Blair Corp., earned \$2,114 on sales of \$87.5 million for the first six months of 1963. Comparable figures last year showed \$1.6 million earned on sales of \$79.9 million.

General Dynamics Corp. had a net adjusted net income of \$26 million, equal to \$2.60 per share, on sales of \$56.2 million for the first half of 1963. First half of 1962 showed \$21.8 million, or \$2.18 a share, earned on sales of slightly over \$1 billion. Decline in sales was attributed to completion of the B-58 bomber and Atlas missile base construction programs. Company's backlog stands at approximately \$2 billion.

Armstrong Mfg. Corp. had sales of \$43 million and profits of \$77,445 for the first six months of 1963. Some period last year showed sales of \$43.5 million with a net loss of \$630,932.

United States Steel Corp. had sales of \$1.9 billion and earnings of \$163.1 million, or \$1.67 per share, for the first half of 1963. First half of 1962 showed sales of \$1.9 billion and earnings of \$86 million, equal to \$1.34 per share.

Lockheed Aircraft Corp. reports net earnings of \$21.5 million, equal to \$2.01 per share adjusted for the 14.7 stock split made June 15. Sales totaled \$903 million for the first six months of 1963. Comparable figures for last year showed earnings of \$18.5 million, equal to \$2.09 a share, on sales of \$4.6 million. Space and space activity accounted for \$102 million in sales during 1963, as cost and related activities, \$442 million, and shipbuilding, electronics, payload units, and other services for \$30 million.

3M Co. reports sales of \$162.3 million with a net income of \$22.4 million, or \$2.08 a share, for the first half of 1963. Comparable period last year showed 3M with sales of \$154.5 million and earnings of \$19.5 million, equal to \$1.88 a share.

Borg-Warner Corp. had sales of \$147.9 million and earnings of \$17.2 million, equal to \$1.87 per share, for the first six months of 1963. First half of 1962 showed sales of \$138.5 million and earnings of \$17.3 million, equal to \$1.67 per share.

Coblec Corp., electronic systems and

instrument manufacturers, reports earnings of \$298,168, or 16 cents per share, on sales of \$6.3 million for the first half of 1963. Comparable figures for last year showed earnings of \$151,180, or 21 cents a share, on sales of \$7.6 million.

Sanders Assoc., Inc., estimates that sales for its fiscal year ended July 31 will be in the \$54.55 million range, compared with \$41.6 million sales for the preceding year. The firm predicts Ford 1964 sales will be in the \$48.575 million range. Net earnings for Ford 1963 equal between \$1.95 to \$1.68 per share, compared with last year's earnings equal to \$1.40 per share.

RELIABILITY of expensive space exploration systems must be assured prior to launch. To help assure that reliability, NASA's space vehicles will undergo as intensive environmental testing as this past space shuttle changes recently completed for the Gemini Space in Flight Carriers, National Aeronautics and Space Administration, Cambridge. The satellite systems will be subjected to the hostile conditions of outer space while suspended within the vacuum thermal shield. □ Designed and fabricated by Grinnell, the airless black thermal shield operates in a vacuum of 10⁻⁷ Torr at temperatures ranging from -320°F. Grinnell, an a subsidiary of the F. J. Stokes Corporation, also fabricated the liquid and gaseous nitrogen thermal shields, cryogenic wiring, data gas 20th level, helium cycles as well as the cryogenic instruments and controls. □ If you demand reliability, let Grinnell put their extensive knowledge and experience in the field of cryogenics to work for you... many companies already are while be informative.



New Gyro Uses Mercury Isotope Mixture

By Philip J. Kline

Washington—First details on an atomic gyro, which uses the angular momentum of spinning nuclei instead of a spinning rotor to measure angular displacement, were disclosed here last week during the International Conference on Atomic Support.

The atomic gyro, developed by the GPR Div of General Precision, Inc., under sponsorship of USAF's Advanced Systems Div., operates at room temperature and requires only coolant for magnetic shielding—a problem which had plagued earlier feasibility models.

First successful gyro operation was achieved last fall. The accuracy when it came to drift and potential future accuracy are classified but because the gyro selectively is not sensitive to external acceleration and does not require any bearings or other external parts, it is susceptible to subnanadian torques, its potential accuracy would appear to be high.

The new gyro uses a mixture of two isotopes of mercury (199 and 201) to the focus of a low-pressure vapor in

a fused quartz container in the basic working unit. In earlier GPR efforts on a nuclear gyro, which began in 1955 under ASD funding, water was used as the working fluid to demonstrate basic feasibility. Apparently two years ago, GPR, involved in the various attempts to get around radioactive shielding and other problems, according to Dr. James H. Shapiro, principal investigator on GPR's atomic gyro program.

At the present stage of development, GPR is directed to give fine production on the ultimate size and weight of a production model gyro. However, Shapiro says the nuclear gyro should easily achieve a volume comparable to a basketball, while external power and control devices would be several times the size. GPR officials say that the new type gyro should be "competitive in size and weight with equivalent gyroscopes."

The nuclear gyroscope makes use of the fact that atomic nuclei with odd numbers of protons and/or neutrons exhibit magnetic moments, properties which result from their charge and spin.

In effect, each nuclei behave as if they were tiny bar magnets mounted on a spinning disk.

When such nuclei are exposed to an external magnetic field, there is a gyroscopic interaction due to the torque applied to a spinning axis which causes the bar magnet to precess so that its north-south magnetic axis spins around the axis of the external magnetic field. (See sketch A, p. 39.)

Basically, only use of easy-to-rotate nuclei is required in this way to the magnetic field while the magnetic axis is rotating, the nuclei assume a random orientation of their bar magnets. Because there are approximately 10 billion nuclei in one cubic centimeter of water, there are sufficient numbers of responsive nuclei for gyro use. In mercury vapor under high vacuum, there are only about a trillion nuclei, but GPR officials estimate to elope a higher percentage of these available than would occur naturally.

The nuclei which are precessing about the external magnetic field have a tendency to emit low pressure energy to maintain aligned nuclei, causing them to slowly slip fluid bar magnets with the axis of the magnetic field unless that energy is replenished by external means. (See sketch A, p. 39.) The time required for 67% of all the magnets to slip themselves, when external energy is supplied, is called "relaxation time." The external energy for use in a nuclear gyro should have a relatively long relaxation time.

To prevent the nuclei from relaxing and to keep them precessing about the steady state (d.c.) field axis, an oscillating (a.c.) magnetic field is used.

When this oscillating field is applied along an axis perpendicular to the plane containing both the d.c. field and bar magnet spin axis, it provides energy to the nuclei, providing the a.c. field is oscillating at the same frequency at which the nuclei are spinning—known as the Larmor frequency. (See sketch C, p. 39.)

The Larmor frequency, in cps etc., is directly proportional to the d.c. field strength and inversely proportional to the mass of the particle. For example, in the presence of a 1.35-tesla field used in the GPR gyro, the spin frequency of Mercury 201 is about 367 cps while that of Mercury 199 is 3,000 cps.

The precessing nuclei can be used to perform the function of an angular displacement gyro whose sensitive axis is perpendicular to the direction of the nuclei precession/d.c. field axis. The

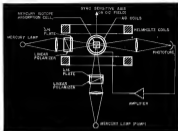
contacts with a conventional gyro which is insensitive to rotation about its table spin axis.

To visualize the operation of the nuclear gyro as an angular displacement sensor it is convenient to imagine that it is possible to schedule so the bar magnet bar magnet in the mercury spin cell and that directly afterwards the device takes in a 360-deg. occupancy rate to provide a continuous accurate reference. Under these conditions it would be possible to observe the accurate location of the spinning bar magnet at any specific instant in time using an extremely sensitive eye or atomic frequency standard in a timing reference.

Using Mercury 199 with a precession rate of 3,000 cps, one might assume that the bar magnet position corresponds to an angle of zero degrees each 0.002 sec., at time 0.001 sec., 0.003 sec., 0.005 sec., etc. If suddenly the container housing the mercury vapor were rotated, say 18 degrees, an observer would now find that at 0.004 sec., 0.025 sec. and succeeding 0.001-sec. increments the bar magnet would be opposite the 18-deg. scale on the compass rose (in the 180-deg. circle, depending upon the direction the nucleus vapor container was rotated).

Should one more fraction of second transpire, an extremely accurate frequency standard as a reference, the advance phase of the bar magnet shifts through an angle equal to the angle through which the nucleus vapor container is rotated.

The phase of the nuclei bar magnets can be determined by passing a linearly polarized light through the plane of the spinning nuclei, to a detector parallel to the d.c. magnetic field. As the nuclei bar magnets spin, they modulate the light beam causing it to vary in intensity. This variation is detected by a phototube which provides a signal indicating the relative phase of position of the bar magnet at any instant.



SCHEMATIC DIAGRAM shows basic operation of nuclear-gyro gyro with sensitive axis perpendicular to the d.c. field (H_0) to measure angular displacement with respect to the pointed gyro. The mercury lamp emits an intense absorption cell as illustrated by mercury discharge lamp (H0) which beam is modulated by spinning nuclei before reaching phototube input. This provides means for measuring relative phase of nuclei, thus indicates angular displacement of gyro. It also provides feedback signal, through amplifier, for controlling frequency of a.c. current which generates oscillating field to keep nuclei spinning. The lower mercury lamp, aligned with d.c. field, indicates number of nuclei available for gyro action.

The modulation imposed on the polarized light beam by the spinning nuclei also provides a convenient means for controlling the frequency of the a.c. power supplied to the oscillating pumping field to maintain it at the proper Larmor frequency. The signal obtained from the phototube is used to generate the correction applied to the grid producing this a.c. field, providing a closed-loop oscillator.

The frequency discrepancy caused that the d.c. field which defines nuclei precession remained roughly constant. Any variation in the magnitude of this d.c. field would cause a change in Larmor frequency which would result

in an apparent change in bar magnet phase angle uncorrigible from that caused by an angular displacement of the device. This would make the device extremely vulnerable. It even has strong magnetic fields or changes in the strength of the earth's magnetic field at different geographic locations, requiring a great deal of shielding.

To get around this problem, GPR uses the nucleus of two isotopes of mercury in a single container: Mercury 199 with a Larmor frequency of 3,000 cps and Mercury 201 with a precession frequency of approximately 367 cps. When there is an angular displacement of the gyro cell containing a mixture



NUCLEAR SPIN GYROSCOPE for measuring angular displacement makes use of angular momentum of mercury vapor nuclei instead of conventional spinning rotor. Developed by GPR Div of General Precision, Inc., under Air Force sponsorship, element now is expected to be the smaller than the experimental unit shown above. Accuracy is classified.



CERTAIN ATOMIC MAGNETS which behave as if they were tiny bar magnets are born of nuclear gyro. When exposed to steady magnetic field (H0), bar magnet precesses (spins) about the axis of the field. If no external energy is supplied, relaxation occurs and precession stops (b). For use in atomic gyro, an oscillating magnetic field is applied which supplies energy to keep nuclei spinning (c).

WAVEGUIDES



Waveguide with 180° twist made to fit a microwave device that has top surface to receive incident signal (left).



Twelve-foot waveguide with 90° twist made to fit a microwave device that has top surface to receive incident signal (left).



Waveguide to connect two microwave devices, one of which is a microwave device that has top surface to receive incident signal (left).



Mill lengths are available from Phelps Dodge Electronics in custom waveguide or from 10-foot lengths.

■ In straight lengths or custom configurations, mill waveguides offered by Phelps Dodge Electronics meet the performance standards called for in advanced microwave applications.

Bending and terminating waveguides into complex configurations at selected frequencies is a prime Phelps Dodge Electronics capability. Twists, bends, coils, offsets, transverse, fabrication and complete assemblies are customarily requested to meet relatively unsketched specifications.

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Solutions to the most difficult, high frequency applications may well be found with the utmost in cabling, off-the-shelf or designed to your exact requirements, matched connectors, specially configured waveguides or cable delay lines. In addition to these pass-band components, Phelps Dodge Electronics offers capability in the development of subsystems for missile check-out and guidance, radar, telemetry, or any fixed network assignment in the microwave spectrum.

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of these two outputs, both modes will experience an identical change in phase angle. But if there should be a change in the steady state magnetic field, each output mode will undergo a different change in phase angle because the Larmor frequency is directly proportional to magnetic field strength. For example, a 1% decrease in field strength would result in a reduction of 10 cps in the Mercury 199 mode compared to a reduction of approximately 347 cps in the Mercury 201, corresponding to nearly a 35 cps in relative phase shift.

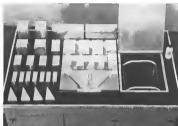
This not only provides a means for discriminating between phase shift caused by angular displacement of the gyro and changes in the d.c. field, but it also provides a signal which can be used to detect any change in the field strength and automatically adjust the current in the magnetic coils to keep it roughly constant.

While the foregoing description of operating principles involves the use of a separate crystal or atomic frequency standard as the reference for measuring the phase of the mercury nuclei, GPL employs a more rigorous approach, instead of using a single cell containing a mixture of Mercury 199 and 201 vapors, two cells are used which are identical except that the direction of the d.c. magnetic field is reversed for the second cell. This means that any rotation of the device about its sensitive gyro axis will produce a phase shift in one cell which is equal and opposite in direction to that produced in the other.

By combining the output from two phototubes, each of which measures the phase angle of its respective mercury vapor cell, GPL obtains a phase reference which is unaffected by rotation of the device. This reference signal then is compared with the phase of one of the mercury vapor cells to measure phase shift due to gyro rotation.

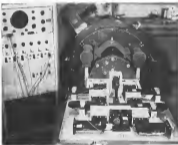
There will be two modulation frequencies imposed on the beam passing through each cell, one at approximately 1,000 cps and one at approximately 347 cps. These signals from one cell are obtained by conventional filtering techniques and compared in phase with the modulated reference signal phase from the two cells.

As previously mentioned, GPL uses external means to increase the population of excited mercury vapor nuclei so that nearly one out of every five has its spin axis aligned with the steady-state magnetic field instead of only one out of a million that would occur naturally. This external means is a carefully pumped high-intensity circularly polarized discharge lamp containing Mercury isotopes 204 which functions as an optical pump. This output isolates phototubes



Test Fixtures Bonded to Fit Requirements

Katharon's Indium Eutectic Alloying uses automatic bonding blocks, deployed on a carrier top of conducting both (above), to fabricate on the spot test fixtures for dynamic shock and vibration testing of products such as waveguide components (below) or other test items. Test fixtures are made by bonding blocks into the required configurations in a carrier of known material of weight by using Eutectic 518 eutectic alloying process. A diamond-tipped soldering solution removes all excess, preventing stress of blocks.



which collide with Mercury 199 and 204 nuclei in the gyro cells and transfer angular momentum to the latter, causing many of the nuclei to cross their spin axis in the direction of the high-intensity light beam. By orienting the light beam so that it coincides with the direction of the steady state magnetic field, the population of oriented spinning nuclei suitable for gyroscopic action is greatly increased.

Originally, GPL employed two light sources, the high intensity Mercury 204

lamp aligned with the d.c. field axis to increase the number of oriented nuclei, and a low intensity lamp at right angles to the other beam used to detect the phase of the spinning nuclei. More recently, GPL scientists have combined the two functions into a single mercury lamp which is placed at a 45 degree angle with respect to the d.c. field axis.

While the nuclear spin gyro avoids many of the problems associated in the design, fabrication and operation of conventional gyros, it is not without



versatility

Brown & Root's outstanding versatility is apparent in even a very brief listing of sophisticated engineering and construction projects it has undertaken with distinction. Power plants to light cities and turn the wheels of industry, large diameter pipeline systems spanning a continent, an early warning radar network guarding a nation, petrochemical plants, developing a new way of life, vast offshore drilling equipment for exploring the earth's mantle: these are representative of

every intricate and highly diverse engineering and construction project successfully undertaken by Brown & Root with an enviable degree of on-schedule performance. Versatility is more than just the capacity to cope with a wide variety of civil, industrial, and marine problems: it is also the ability to deal harmoniously and efficiently with all aspects of a single undertaking to the end that it may be accomplished in the most economic and rapid manner possible.

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challenging problem most peculiar to its new design, GPL, optoelectronic code. This is evidenced by the fact that approximately the same effort and nearly \$500,000 of Air Force funds have been acquired in advancing the technique to its present state, which is described as "experimental." GPL is hopeful, however, that added government funding will be obtained to advance this key technique into a viable prototype design.

One problem area, for example, is the design of an extremely phase-stable amplifier for the feedback loop in which radio modulation of the light beam is used to control the frequency of the a.c. field which must maintain synchronization with the master laser frequency. An extremely small resonant, phase-locked in that amplifier and feedback circuit results in the equivalent of radio drift in a conventional gyro, Simpson points out.

Similarly, air variability in the output intensity of the lamp used to direct radio position will result in a spurious amplitude modulation which introduces that due to radio spin. Extensive passive angular relationships are required between different elements of the atomic gyro.

These are what Simpson calls past and continuing technical problems—difficult



PERT Computer

PERT calculates this rate enables operator to manually compute PERT expected time, earliest and latest event times, slack, critical path and probability of meeting schedule, both on an absolute and probability basis. New PERT-CGRAPH II control path computer was developed by James H. Smith in accordance to earlier expected time data rule (AIEE, Mar. 7, 1962, p. 181). Slide rule is available from \$5.00 from James H. Smith Associates, 405 California Ave., Palo Alto, Calif.

and demanding but not overwhelming." The ultimate limit on the accuracy of a nuclear gyro given is established by

the statistical nature of the device. In the GPL, memory storage unit with optical pumping and to measure the population of nuclei spinning in motion, there still are about 50% of the nuclei which are causing a completely random fluctuation. This generates a random fluctuation in the modulation of the light beam used to determine phase of the signal output, sometimes referred to as "superposition noise."

Current theory suggests, however, that this will not be a serious limitation for any potential gyro requirements, meaning to Simpson.

General Precision is not the only company active in the nuclear gyro field. Other teams to be working in the field include American Bosch Arma, General Electric, Republic Aviation and Sperry Rand-Honeywell Co. The idea of using the electrons or nuclei which enter conveniently sets in spinning motion is an old one.

In 1951, Santa Anaconda devoted some effort to the concept.

General Precision expects to achieve four patents next year concerning some of its basic techniques for a nuclear gyro. The patent delivered at last week's American Society Conference was partly authored by Simpson, J. T. Foy and John A. Greenwood, Jr., all of the GPL Co., Pleasantville, N. Y.

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MOON SAFARI

10,000 MILES FOR A 37-SECOND MISSION

What is the exact shape of the moon? Interference of the earth's shadow has long prevented men from determining it. To solve this mystery, an "inclipse expedition" from Lockheed's Rye Canyon Flight Center recently traversed 10,000 miles in Outhoven, South Africa. They photographed the moon under ideal scientific conditions—for the 37 seconds it was silhouetted against the sun's near-perfect circle.

The precise measurements secured by this "inclipse safari" provide added information on the effects of moon gravity; data of great importance in planning lunar landings and computing the lifeline of vehicles which will orbit the moon.

Lunar and planetary studies are but one of the basic projects under research by Lockheed scientists and engineers at

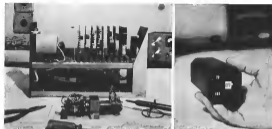


the Rye Canyon facility. Others include: Astrodynamics; Communications; Optics; Plasma; Solid State; Solar; Sea and Biophysics; Thermodynamics; Aerodynamics; Propulsion; Airframe and Space Environment. Research projects at other Lockheed California facilities include work on America's super sonic transport, ARW and Cruise Systems, and Spacecraft.

SCIENTISTS AND ENGINEERS are invited to explore the exciting future these projects offer one of top-level talent and training. Write: Mr. & W. Don Laurier, Manager, Professional Placement Staff, Dept. 1120, 2601 N. Hollywood Way, Burbank, California. An equal opportunity employer.

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OPTIMIZE COMPUTER PROGRAMS are mounted separately explains flight characteristics to simplify maintenance. Earlier computers held in about 1 ATR size. Note some can, removed from computer, in background. Pilot's flight indicator (right) permits inside cockpit display of difference between actual and programmed value. Pilot flies to indicator (below) the CRP flag warning, which appears much like a sensitive pitch indicator. System is intended to permit accurate flight at optimum conditions regardless of gross weight, center of gravity and other variable conditions throughout steep climb phases of flight, such as rotation for takeoff, climb and landing.

Optimizer Programs Best Angle of Attack

By Barry Miller

Denver, Colo.—A flight optimizer, or speed command system, designed for possible use on the Boeing 727 jet transport, has been developed here by General Controls Co.

The flight optimizer is intended to enable a pilot during critical steep-climb phases of flight to fix at an optimum condition separation of aircraft gross weight and other variables by maintaining specific programmed angle of attack. The system is based on the belief that for every flap position of the aircraft there is an optimum angle of attack. And by controlling to this angle of attack it may be possible to achieve an optimum flight condition.

Prototype Delivered

A prototype of the equipment recently was delivered to Boeing where it currently is undergoing simulation tests. Flight tests are expected in the fall. Other companies, including Sels Flight Instrument Corp., which developed a Fenelonville variable speed command system for other aircraft (AVT Oct. 17, 1968, p. 32), are working on related devices.

A version of the type may be made available to optimal separation to crews using the new Boeing jet transport. At least one error is considered to be corrected in a version of this type for its 727 aircraft.

In the General flight optimizer sys-

tem, the pilot fixes to an indicator needle. The display is a measure of the difference between the aircraft's actual angle of attack and a programmed value, with the needle centered when these values coincide. Initially, the indicator is centered during takeoff roll. After liftoff, the system will command a steady climb at a steady angle to the point where the aircraft is climbing at an optimum angle, according to the computer.

Once other factors, such as optimum Mach number climb, take over, the indicator moves off scale. Unchecked maneuvers caused by wind gusts or an engine failure will not cause the aircraft to deviate from its optimum pitch during climb.

The pointer returns to scale as the aircraft slows during its approach. It appears a host could be mounted to a desired approach angle of attack. An "approach code" reference is watched automatically into the computer about 5 min. after liftoff and its operation confirmed by the appearance of an approach indicator flag on the pilot's indicator.

Should the pilot make a mistake, the optimizer would tell him the optimum angle of attack to follow for the aircraft's speed and configuration. He would hold the needle centered and he would would ease out to a proper value for that configuration.

General has flight tested the system in a light aircraft in tests looking about

40 hr in duration. These indicate that the system works effectively, according to a company spokesman.

The system is composed principally of a small computer, based on a short 3 ATR case, and a tape-type flight indicator. Angle-of-attack signals are received from sensors placed in vane assemblies for the 727 stall warning system. In addition, a case and structure are associated with the flap position transducer in the stall warning system to compensate for changes in aircraft geometry.

Modular Construction

The computer is fabricated along modular lines, with individual printed modules mounted on a number of removable printed circuit boards, each containing separate functions. This is aimed at simplifying the task of maintenance and replacing faulty parts. General says it does not expect an customer to have to replace more than 10% of the modules over the 15-year lifetime of the aircraft.

Collaboration is not required in current parameters are maintained by feedback techniques and the use of precision valued components.

An "all" flag covers the indicator when power is not applied, but once power is turned off or in the event of a failure. Two other flags indicate modes—take off or approach. A single pin to test switch on the ground indicator tests the computer's supplies



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ENGINEERING IN PLASMA TECHNOLOGY is exemplified by this and a host of other state-of-the-art developments, including: highly efficient laser systems, laser systems for chemical synthesis, shock wave photography, visual control physics and other extremely demanding applications from night aerial photography to optical oceanography.

EG&G is its field's opportunity explorer and an able engineer from qualified scientists and engineers. Growth comes major opportunities in research for nuclear rocket, reactor control and radiation detection and measurement and in the development of instrumentation and computers for these and other purposes. Contact Glen Harris, Dept. AW33, 60 Brookline Avenue, Boston 15, Massachusetts.

Circle 10 on Reader Service Card



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and radiance currents and makes possible simple visual inspection of the indicator lamp.

The optimizer signal is derived as a sum of two signals from the two angle of attack vane in the flap position transducer. The signal is compared with a reference, transmitted to the computer, demodulated, filtered and passed to a summing amplifier network at the input to an operational amplifier which drives the indicator. The angle of attack display has low gain and fast response, the computer one.

To assure a continuously varying angle of attack during the periods from lift-off to steady-state climb, a bias signal is applied to the operational amplifier through these intervals. The bias is derived from a function potentiometer and goes to zero volts at periods other than take-off and approach.

During the transition from lift-off to steady-state climb, the speed of a trajectory sensor in the computer is varied to take into account changes in aircraft thrust-to-weight ratio by commanding zero rate with acceleration signals.

The latter are obtained from an accelerometer, as located in the computer that its sensitivity is parallel to the aircraft's longitudinal axis.

The flight optimizer will stabilize both short period and phugoid oscillations. Short period response, Gering points out, corresponds with the response of an expanded scale stability graph so that no changes in plotting techniques are necessary. For phugoid stabilization, an indicated air speed signal is filtered and differentiated, applied as an input to the operational amplifier in such a manner that increasing airspeed alerts the pilot to increase the angle of attack.

To correct for descent from high bank altitudes, the maximum positive pitch attitude recommended by the crew is limited typically to about 15 deg. This is done by picking off a signal from a vertical reference gun, displayed on the screen for the crew member's review and using it as an error rate.

The gun signal is demodulated in the computer, filtered and applied to the operational amplifier to provide the angle-of-attack signal when pitch exceeds the desired limit.

Output is available from the computer to drive speed of multiple indicators should they be added. An output for command signals to the aircraft autopilot also is available, although during the autopilot with appropriate angle-of-attack signals is not now contemplated.

General has, however, conducted studies of the possibility of controlling thrust with angle-of-attack information.



Ruby Laser Beam Ionizes Air

High-power light beams from a ruby laser (left) ionize the air in a flask of light to the right of the small lens. Lens focuses the light to a point creating an extremely high electric field. The lens is Kodak Corp.'s experimental K 101 unit, with a peak power output of 500 megawatts.

FILTER CENTER

► **Berlin Develops Mount Air Filter**—Lightweight radar altimeter which was solid-state construction and weighs only 21 lb has been developed by Standard Telephone & Cable Ltd., in response to its order 53 lb tube model which demonstrated high accuracy in recent Federal Aviation Agency blind landing tests (AW June 18, p. 127). The new STA 57 altimeter, which uses CW FM techniques is expected to offer competition to the Minneapolis-Honeywell unit for use as new jet-aid automatic landing systems.

► **TWA Buys New 3-D Indicator**—Trans World Airline has become first airline to order new three-dimensional light director indicator developed by Collins Radio, which has capabilities of depth and color in perspective-type virtual situation display. (AW Aug. 5, 1963, p. 91) TWA has placed 5430, 800 indicator with Collins for integrated light director system, with new 3-D display for use on new fleet of short-range jets.

► **Computer Market Tightens**—The shut-out of digital computer manufacturers, particularly in the highly competitive aircraft market, a trend first reported by *Aerospace Week & Space Technology* (April 18, p. 112),

is continuing. Philips, which recently consolidated its computer divisions into its communications and electronics division, has announced that on the future it "will not actively seek industrial data processing business" but instead will place primary emphasis on military command and control and industrial scientific applications. ID Technics, Inc., Worcester, Pa., has announced that it plans to acquire manufacturing facility in up state.

► **On The Corporate Checkbook**—Recent acquisitions and corporate changes in the recent industry include the following:

► **General Precision, Inc.**, has sold its financial interest in Rembit Systems Corporation, Newton, Mass., to Stephen Goshin, president of the latter company. GFI will, however, continue its work in microelectronics at research facilities on the East and West coasts, company says.

► **Electronic Communications, Inc.**, St. Petersburg, Fla., has purchased substantially all the assets of Electronic Instruments Inc. Research, Inc., Baltimore.

► **The Sager Matrix Div.**, of The Sager Co., has reached tentative agreement to acquire assets of Sager Systems, Inc., Amsterdam, N. Y., in stock exchange deal, making division's third

ductor Div., Special Products Dept., Youngwood, Pa.

• **High power laser**, with output of more than 1,500 joules per pulse and input of 150,000 joules per pulse, is now available from Miter Optics, Inc., 89 Brighton Ave., Boston 26, Mass. Company claims it is the highest power laser on the market.

• **Integrated science amplifiers**, new silicon semiconductor device which performs exact functions of a transistor plus a meter diode in a regulated voltage or current power supply. Device has

integrated structure which reduces effects of long and short-term drift of reference voltage, especially providing temperature coefficient as low as 0.015%/deg C. Integrated amplifier, housed in a transistor case, currently is available in 10 different models. Manufacturer: General Electric, Semiconductor Products Dept., Syracuse, N.Y.

• **Almost idealized system analyzer**, for use with 400 cps x-c system, enables operator to locate malfunction and check system performance in 10 min. Analysis is contained in portable



case measuring 21 x 18 x 13 in. and weighing 55 lb. Manufacturer: Westinghouse Aerospace Electronic Div., Box 599, Lima, Ohio.

• **Microcurrent automatic tester**, Model 678A, performs 50 tests on devices with up to 54 terminals, with pass-fail-passing accomplished by means of precision relays on a plug-in board



Two leads are connected to each terminal, one to supply power and one to make measurements to prevent constant resistance error. Bias conditions are adjustable.

When used with a comparison device, tester can be used to automatically sort microcircuits according to their characteristics.

Manufacturer: Test Instruments Inc., Industrial Products Group, 3699 Buffalo Speedway, Houston, Texas

• **Low-frequency magnetic recorder**, Model 6837, utilizes Hall-effect sensing heads to achieve low-frequency response and provides output impedance for recording using type graphs. Recorder does has frequency range of 7-2,000 cps and has a turn-down on the drum which permits system synchronization or signal follow-up.

Manufacturer: Instrument Systems Corp., 111 Canagaga Road, Waukegan, Ill., N.Y.



A new addition to the Ferranti range of 3 1/2" Artificial Horizons is the PH 77. It comprises: (1) CLAMP MOUNTING, (2) INTERNAL LIGHTING, (3) 1700 AMP. AND 1000 WATT. 240V. POWER SUPPLY, (4) 240V. 50/60 HZ. SUPPLY, (5) 240V. 50/60 HZ. SUPPLY, (6) 240V. 50/60 HZ. SUPPLY, (7) 240V. 50/60 HZ. SUPPLY, (8) 240V. 50/60 HZ. SUPPLY, (9) 240V. 50/60 HZ. SUPPLY, (10) 240V. 50/60 HZ. SUPPLY, (11) 240V. 50/60 HZ. SUPPLY, (12) 240V. 50/60 HZ. SUPPLY, (13) 240V. 50/60 HZ. SUPPLY, (14) 240V. 50/60 HZ. SUPPLY, (15) 240V. 50/60 HZ. SUPPLY, (16) 240V. 50/60 HZ. SUPPLY, (17) 240V. 50/60 HZ. SUPPLY, (18) 240V. 50/60 HZ. SUPPLY, (19) 240V. 50/60 HZ. SUPPLY, (20) 240V. 50/60 HZ. SUPPLY, (21) 240V. 50/60 HZ. SUPPLY, (22) 240V. 50/60 HZ. SUPPLY, (23) 240V. 50/60 HZ. SUPPLY, (24) 240V. 50/60 HZ. SUPPLY, (25) 240V. 50/60 HZ. SUPPLY, (26) 240V. 50/60 HZ. SUPPLY, (27) 240V. 50/60 HZ. SUPPLY, (28) 240V. 50/60 HZ. SUPPLY, (29) 240V. 50/60 HZ. SUPPLY, (30) 240V. 50/60 HZ. SUPPLY, (31) 240V. 50/60 HZ. 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INTERNATIONAL AIR TRANSPORT ISSUE

October 7, 1963

To meet the information challenge created by the international character of aviation, AVIATION WEEK & SPACE TECHNOLOGY publishes each year an issue devoted to international air transport progress. This issue is enriched with such enthusiastic reports that it will again be greatly appreciated to provide the most comprehensive analysis and forecast of the air transport industry and its technical developments.

Publishing date is October 7, 1963, timed to coincide with the annual general meeting of the International Air Transport Association (IATA) in Rome. Copies of the issue will be flown to Rome for distribution at the opening plenary session to airline presidents, IATA delegates and other world aviation leaders.

Issues theme will be the current problems in international air transport including bilateral agreements, rates and traffic flight equipment, passenger, mail and cargo traffic, air traffic control, the capacity issue, a change of air national routes. Other subjects essential to a full analysis of the airline industry world will be stressed including trends in super-jet transport development, military transport operation, survey of Russian and Communist Bloc airline activity, impact of U.S. international transport policy on world political and industrial relations.

Feature treatment will be given to trends and projected future prospects for traffic growth and development of flight equipment in all major world markets, North and South America, Atlantic Pacific Europe, Africa, Middle and Far East. Analysis illustrated, it will also contain specially prepared charts and graphs to show growth and forecast trends.

This impressive list of topics slated for coverage will involve the world-wide editorial staff of AVIATION WEEK & SPACE TECHNOLOGY. Timeliness of the issue date coupled with AVIATION WEEK's reputation as the authoritative, respected voice of international aviation promise to make it the most important advertising opportunity of the year for your equipment, products and service to the airlines. Identify your role in air transport at a time when attention will be focused on major industry needs.

**Aviation Week
& Space Technology**



present mentioned. Although passengers were not injured at the accident, the captain stated that passengers were seen to panic. In the vicinity of the TWA Flight 700, flight instructor was encountered and the captain stated that the "plane was built up." A few minutes later, the instructor stated that the sign was left as an indication of the distress in Bradley Field. Shortly thereafter, a gradual descent was commenced.

Bradley Approach Control was contacted and Alhambra Flight 901 reported being about 16 mi. southwest of the WTC radio tower which is located near Bradley Field. The transmission was acknowledged and the flight was instructed to make a straight-in approach to runway 6. The Bradley Field accident was either then and shortly after more than 15 mi.

Explosive Decompression

Just after passing through the 4000-ft. level, at approximately 2051, there was an explosive decompression, immediately, the crew felt as the aircraft and the service door, warning light illuminated. The decompression was of the cockpit cabin door which was blown approximately eight feet down the cabin side by the instant of decompression. The second section was in the lavatory. The decompression ripped the

lavatory door loose as being and forced its occupant to the floor. The first person, who was in the lavatory area, was ejected through the rear service door which had blown open, and fell to his death.

Bradley Tower was advised of the accident and subsequently a search landing was requested. The search lasted for 2 1/2 hr.

Aircraft Damage

Investigation by the Civil Aeronautics Board at Bradley Field disclosed that the lower edge of the rear service door was one foot away from the lower lock pins and headed inward. The upper locking handle was over the upper lock pins, however, the handle was twisted and bent outward. The door handle was in the open position, aligned with the upper reference arrow printed on the door frame.

The overpressure door latch had separated at the horizontal end designed failure area. The vertical portion remained attached to the handle and the horizontal portion separated at the attachment point to the upper of the door. The upper edge had the door was intact, showing the arms to become wedged between the door and panel at the side rail.

The rear service door was removed from the aircraft, under CAA supervision and the wiring system was checked. Two plunger



Planetary Flight Calculator Shown

Interplanetary navigation using system is designed for rapid calculation of flight paths to Mars and Venus. System also calculates flight paths to other planets during any time period. Both extending from the heliocentric reference in three dimensions. Calculations are made from readings that appear on the disk and scale. North Chicago, right, director of advanced studies of General Dynamics/Astronautics, developed system.



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the rear screen door warning light system. However, the system does not indicate the position of the two air landing locks.

The closing procedure of the rear screen door at Philadelphia resulted in an abrupt engagement of the air lines landing lock over its lock pin. The abrupt latching of the screen door was not indicated by the warning light and would be difficult to detect by reference to the position of the door handle. The slight displacement from the locked position could only have been evidenced in a visual inspection. The use with which a potentially dangerous condition could occur was demonstrated in the ground test previously described.

It is concluded that the partially engaged lock air landing lock resulted in the

explosion during the climbout from Philadelphia and subsequent return flight. The descent to Landing Field, with the resulting decrease in pressure differential, forced the screen door to the partially engaged, locked position over the lock pin. The normally gradual loss of air landing lock allowed the lower portion of the door to be detected by pressure which, when sensed by aircraft instruments, caused the crew to land to move toward the open position. When this lock became disengaged, further vibration of the door occurred and the door handle traveled to the fully open position, thereby disengaging the latched lock lock, resulting in explosive decompression. Its similarity prior to the decompression, as indicated in a pressure differential of 3.7 psi,

the total force exerted on the door would have been in excess of 1,800 lb. Therefore, it can be concluded that severe damage to the door frame and explosive decompression would be expected from the accident.

Although the flight crew could reasonably be expected to determine that the screen door was open, it is evident that their reliance of the lock to be the result of a door lock was not in the view of the landing of many subsequent passengers of the door lock experienced by Alhaghi in operating the Conquest 340-140 aircraft. The Board believes that the crew should have recognized the possibility of dependence of the aircraft, and moved the flight simulator and passengers to avoid the rear screen door area.

Probable Cause

The Board determines that the probable cause of this accident was an unbalanced in-flight latching of the rear screen door or wiring in an in-flight explosive decompression which resulted in a loss from the aircraft.

Contributing factors were Alhaghi's Air Force inadequate emergency procedures instructions, and the inadequacy of the post accident flight safety discovery of the post accident lock.

Recommendation

Conquest Service Bulletin 126A, dated June 1, 1978, recommended improvements to the door lock and warning system. The Civil Aeronautics Board, on May 13, 1978, recommended to the Administrator of the Civil Aeronautics Administration that an Airworthiness Directive be issued that would have made mandatory the changes noted in Civil Conquest Service Bulletin 126A, which called attention to the difficulties experienced with the door and emergency compliance with the Conquest Service Bulletin. Additional Conquest Service Bulletin dated May, 1978, October, 1978, and January, 1979, were issued recommending improvements to the rear screen door.

N 341-580 was produced by Alhaghi before and subsequently placed into operation on April 12, 1978. The provisions of Conquest Service Bulletin 126A were incorporated in N 341-580, however, the majority of the Conquest Service Bulletin provisions for rear screen door improvements were incorporated in N 341-580 prior to production use exclusively by Alhaghi.

On May 13, 1978, the Board action mandated to the Federal Aviation Agency that methods for ensuring the Conquest 340-140 rear screen door system be considered such that the airplane of this type require modification to a satisfactory safety level. Consequently, the Federal Aviation Agency issued an Airworthiness Directive, effective May 15, 1978, requiring modification of the structure of Conquest 140-140 rear screen door incorporating improvements contained in Conquest Service Bulletin.

The Agency directed Alhaghi to request, among other things, that the Airplane Flight Manual be revised to contain instructions of the latching being correct and each time the door screen door is opened.

• The aircraft is approximately 4 years in

existence of a latch disengagement or lock up around the door.

• Inspection holes and lights be installed to improve visibility of the door latch and lock.

• Door latching electrical warning facilities be installed in the upper and lower forward fuselage.

By The Civil Aeronautics Board
 Alan B. Ebel, Chairman, Robert T. Mayhew,
 Vice Chairman, Glenn Conway, Member,
 Ed James, Member, Maurice, Whitney Gil-
 land, Member

Investigation

The Civil Aeronautics Board was notified of this accident at 7:10 p.m. on Oct. 18, 1968. Civil Aeronautics Board investigations were immediately dispatched to the scene and an investigation was conducted in accordance with the provisions of Title 14 of the Federal Aviation Act of 1958, as amended.

Air Carrier

Alhaghi Airlines, Inc., holds a current certificate of public convenience and necessity issued by the Civil Aeronautics Board to engage in the transportation of persons, property, and mail. It also possesses a valid air carrier operating certificate, issued by the Federal Aviation Agency.

Capt. Harold G. Goshall, age 39, holds a valid Federal Aviation Agency issued transport pilot certificate with ratings for the Cessna 340, 441, Conquest 140-140, Conquest 340. Capt. Goshall has a total of 34,418 flying hours of which 1,800 were in the Conquest 140-140.

First Officer Donald T. Sullivan, age 34, holds a valid Federal Aviation Agency commercial pilot certificate with instrument rating. He has approximately 8,000 flying hours of which an estimated 1,700 is in a Conquest aircraft.

First Officer Patricia De Mott, age 29, had an estimated flying time at LEROI of approximately 440 hours of which some in Conquest aircraft.

Second Master Katherine Lacy, age 26, has 155.5 hours of flying time at which 79 hours were in Conquest aircraft.

The Aircraft

The aircraft is a Conquest 340-140 U 5 August 1968 (N 341-580), serial and approved by Alhaghi Airlines, Inc. It was constructed on Oct. 16, 1968, serial No. 121. The total time on the aircraft was 18,968 hours at the time of the accident. The engine was a Pratt & Whitney Canada CT-100 C1B, with a maximum rated power, model 611-58.



USAF Builds Jet Weather Fleet

Building W-47 flying weather fleet being done by USAF's Air Weather Service, has strong similarity, yet, it is not a direct copy, is analyzed, modified and then adapted to ground weather stations for use in preparing forecast maps. Lockheed-Georgia Co. is converting 14 W-47s for weather mission. The fleet will fly approximately 25,000 hours a day on regular routes.



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news, 10/1/88.



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LETTERS

X-21A Coverage

ANALYSIS: While the June 14 article (p. E1 E2) on the NIOSH banner fire control demonstration airplane has received much comment here. This article undoubtedly will do much to extend the understanding of details about the airplane and its testing program. In the interest of simplification and clarification, I am writing to add several comments regarding possible future applications of LFC.

With regard to cargo aircraft operations, the reduction in pilot/cockpit requirements will be more than offset. In fact, in fact, he asserted. The thrust of the studies and more consistent engines will be adequate for military because the LFC wing is large and provides additional lift. In all of our LFC operations studies, the matter of reduced fuel length is an essential parameter for comparison of performance of turboprop and turbine aircraft. In none of these studies has there been a finding that turbine aircraft would need additional passengers to takeoff.

LPC is most applicable to the workplace parent assault concept. LPC's spectrum is in the long range or long confidence or higher (includes as required for lighter and nonoffense reasons and for the uniform command and communications center concepts, to name but a few applications of the nonoffense analysis).

Concerning experimental applications: No strong dependent wind tunnel tests to date have indicated that laminar flow control can be sustained on swept wings in front of or behind the Mach cone. Further and more extensive tests are planned.

W. E. Collins

Vice President and Assistant General Manager, Technical

Science Day

1992-1993
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Postscript: Larry
Henderson, Ed.

MA-9 Sightings

Those who would categorically demand Mr. Cooper's sighting of small ground objects while in orbit had better review a bit of recent history. The most detailed escape map, that of the long the USSR space system was proposed, it was calculated by a somewhat subtle argument. They could an orbiting system, whose dimensions were so small that the beam width could not enable to better than 10 deg., over given directional information to within three degrees! That is a 'Much less' approach to the problem, when an appropriate physical law a stepmop on the outside vehicle used in the controls.

The problem of after-high optical noise may be attacked by customers from a point of view of "jitter." This is the way in which our perception system determines such things as control task levels. A jitter which serves to modulate the image on the retina with an amplitude of the order of the spacing of the corporate elements could conceivably operate to make a distance smaller than the discussion of the sensory channel. Indeed, temporal compression

Armenian Week welcomes the opinions of its readers on the issues raised in its magazine's editorial columns. Address letters to the Editor, *Armenian Week*, 338 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of authors will be withheld on request.

would probably be reached, since it seems unlikely that the network would allow for phase compensation of visible light.

Larry Macer,
Rutgers University, N. J.

Regarding the diagrams expected over May, Cooper's report of thermograph wall slabs from MA-9 during his trip, Mr. Cooper saw what he said he saw. It is quite easy to explain what was it normally he considered the annual road nearly covered in these writings. Mr. Cooper had the help of a lot amounts to a psychic drawing from the earth's atmosphere, to suggest objects to be sure things he might, should not have seen (see sketch below).

Seen from a vantage point in space and into the visible atmosphere, two flows in direct contrast will be observed in this, too: (a) as they pass from the dense medium of our atmosphere into the emptiness of space, they will rapidly diverge as such very low speed. Because of the magnitude of the order of turbulence and the rather poor definition of the reflecting "face" of the atmosphere which forms the diverging lens, the magnification would not be great—only enough to easily get the good news confirmed.

Wissinger, Gregory
New York, N. Y.



Regarding the comments of Dr W. E. Aley (AW June 17, p. 16) and reader Donkerly (AW July 15, p. 96) and others who have denigrated or dismissed as irrelevant Maj Cooper's opinions, there are just as wonderful as the signs which "proved" that men could not fly. While I do not have the exact scores of either Maj Cooper or reader Schenck (AW July 8, p. 96), a simple experiment that just debunks the opinion proved to me that Cooper's opinions are completely reasonable.

It is necessary only to pick up and while driving a distant single electric or telephone wire (just visible) of approximately 1 m. diameter and note the damage to target. I consistently picked out such targets at 8.5 to 34 m. which indicates a minimum info. of 75,000 bits. I We have permission to graduate from rifle to gun once you accept pistol "buck" as gospel against the tests most of seemingly competent men such as Maj. Cooper and who were the painted "truths" instead of sitting up an intuitive experiment and analysis. Perhaps the path's atmosphere also acted as a slight loss to Maj. Cooper's eyes!

ELMER C. SMITH
New York, N. Y.

ATC Equipment

[illegible]

The top part is that no recognition is given to the accomplishment. Alas, even in many parts a health of badly-dubbed, without men in the Germany Department (the group) and the German in the place, which is not the case. The most part of equipment in well it did it something of a match. The equipment engineering and procurement people enable) added to up-to-date—then needed a lot of labor and only so much money was forthcoming each year. Some of the broken and badly-built contractors will also paid and sent this "manure" was accumulated in some equipment delivered at very low prices. The equipment was given to some of a bunch and hastily abandoned hospitalized almost alone.

But, there is a long way to go but a favorable climate has put several producers and action ahead that it is not being ignored.

Robert Berman
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